Rock Products

Vol. XXIII, No. 21 CHICAGO October 9, 1920

NATHAN C. ROCKWOOD.....Editor
CHAS. A. BRESKIN.....Assistant Editor
GEO. P. MILLER.....Manager

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Chas. H. Fuller, Manager

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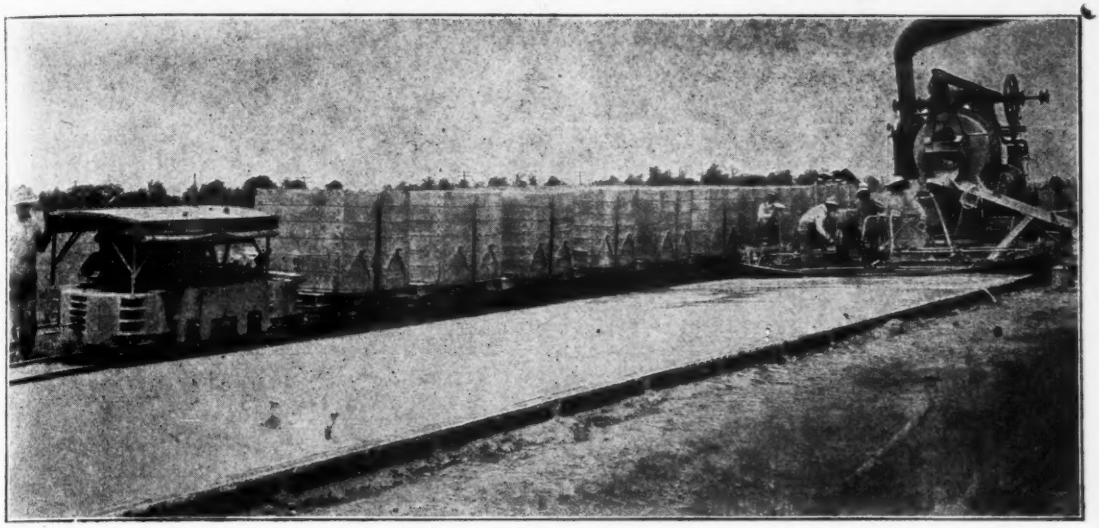

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It is the Plymouth Locomotive that bridges the gap between your apportioning plant and the mixer. They keep both ends busy and fatten the profit side of the ledger. Ask us about them.

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Plymouth, Ohio **Riggs Ave.**

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Gasoline Locomotives

Make a Profit from Your Waste

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"Crescent" Power Brick Machines tamp individually 12,000 brick a day.

Write for Bulletin No. 50 for further information.
We have "Crescent" Machines ready for shipment.

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"ONE MAN - ONE MINUTE" ACCESSIBILITY

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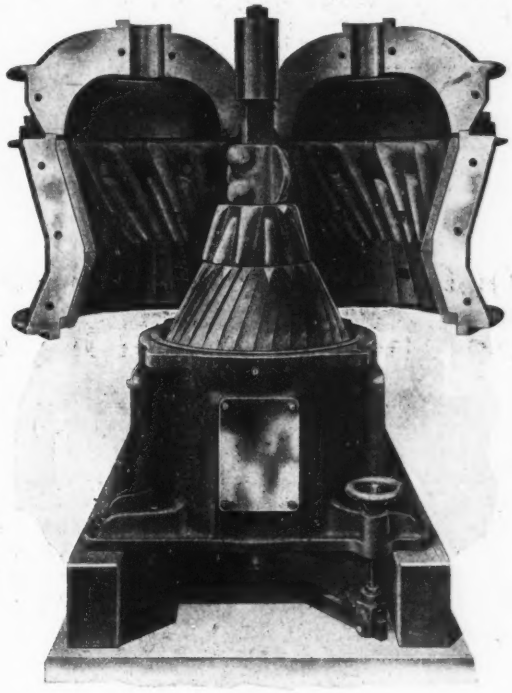

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"OPEN-DOOR" ROTARY FINE CRUSHER

FOR REDUCING SOFT AND MODERATELY HARD MATERIAL TO ONE-HALF INCH AND FINER. FOR LIME, GYPSUM, SHALE, CLAY, CLINKER, COAL, ETC., THEY ARE UNEQUALLED

Unfasten the bolts, throw open the door and get at all wearing parts. One man can open the door in a very few minutes.

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"Open-Door" machinery pays because it operates more continuously than any other, therefore production is greater and less time and labor are necessary in case of obstruction or repairs.

BUILT IN FIVE SIZES

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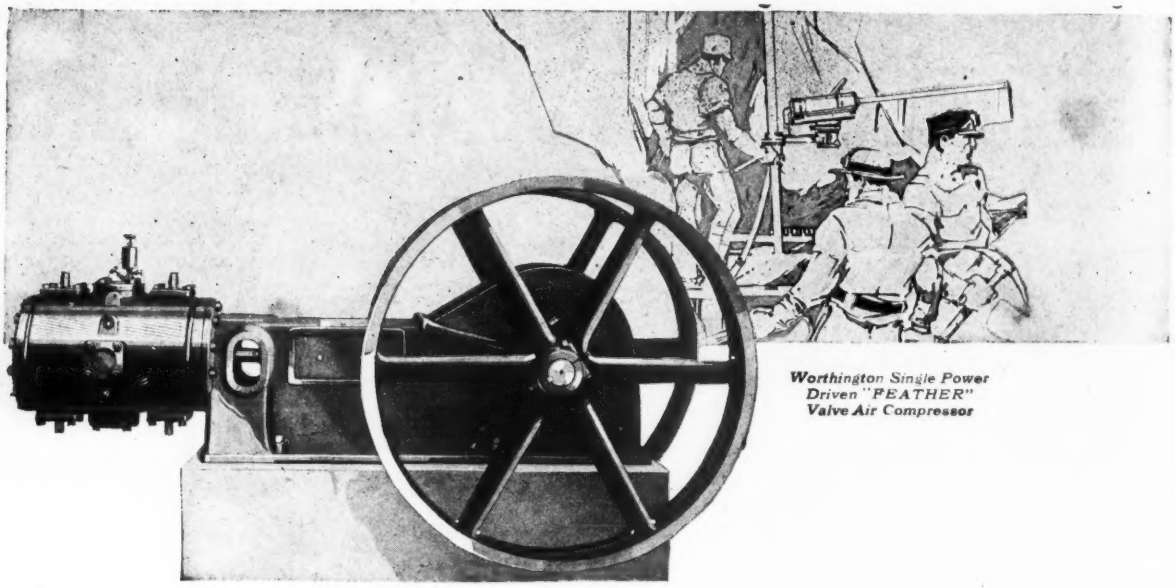

Worthington Single Power Driven "FEATHER" Valve Air Compressor

1000 Pounds Pressure and the "FEATHER" Valve

(REG. U. S. PAT. OFF.)

THE "FEATHER" Valve in Worthington Air Compressors, which successfully stands pressure up to 1000 pounds, is a thin strip of ribbon steel.

The "FEATHER" Valve is the strongest, most simple, long-lasting valve in service. It has but one moving part—"a ribbon of steel," which weighs less than one ounce, and functions by bowing in center against slotted curved guards to permit passage of air or gas and closes by gently straightening into place on ground face slotted seats. There is no friction or hammering action as with many other types of valve.

The "FEATHER" Valve, because of its efficiency, prevents fluctuating pressures and guarantees an always ready, reliable air service for Shop, Foundry or Mine.

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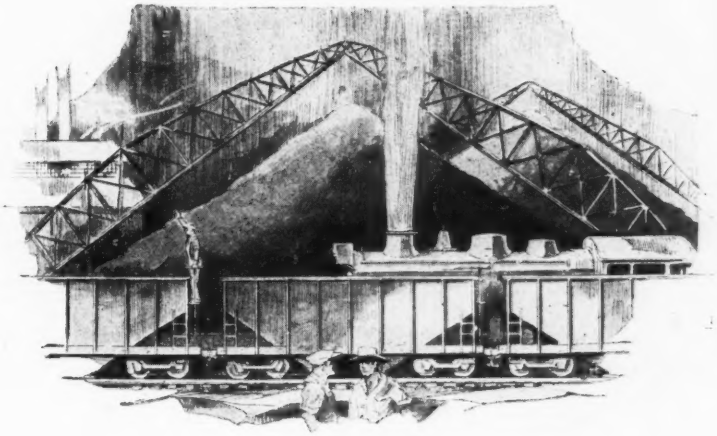

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The fuel efficiency of Rotary Kilns, whether used for cintering, nodulizing, calcining, drying or retorting, is of ever increasing importance because of the cost of fuels.

To this important saving are added the advantages of lower labor cost, low maintenance and CONTINUOUS OUTPUT. Charging and discharging are an uninterrupted process. Rotary Kilns do not have to be held idle while a new charge is being put in, or the finished one withdrawn.

In addition a variety of fuels may be used in VULCAN Rotary Kilns—coal dust, producer gas, natural gas, oil.

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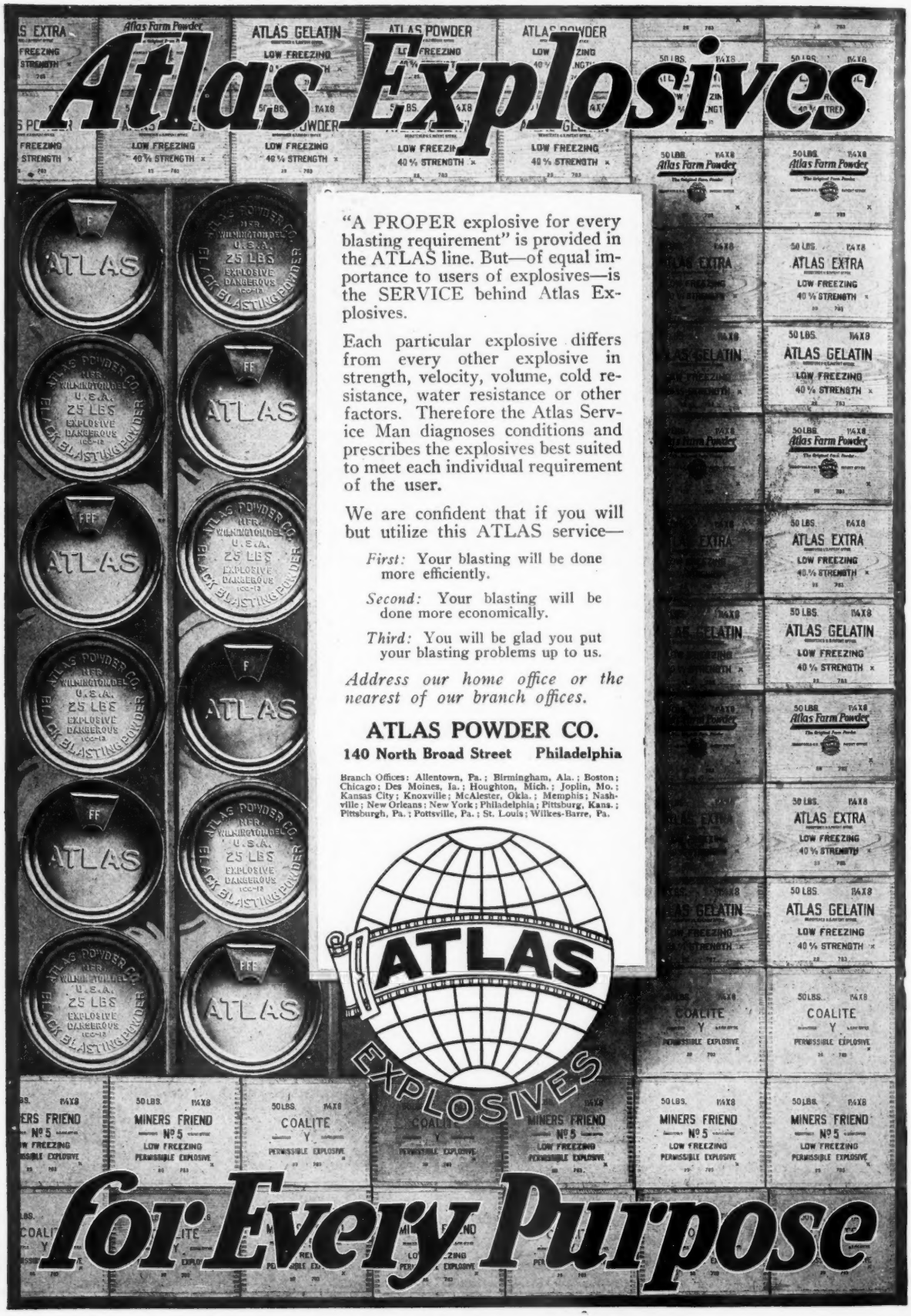
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Each particular explosive differs from every other explosive in strength, velocity, volume, cold resistance, water resistance or other factors. Therefore the Atlas Service Man diagnoses conditions and prescribes the explosives best suited to meet each individual requirement of the user.
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First: Your blasting will be done more efficiently.
Second: Your blasting will be done more economically.
Third: You will be glad you put your blasting problems up to us.
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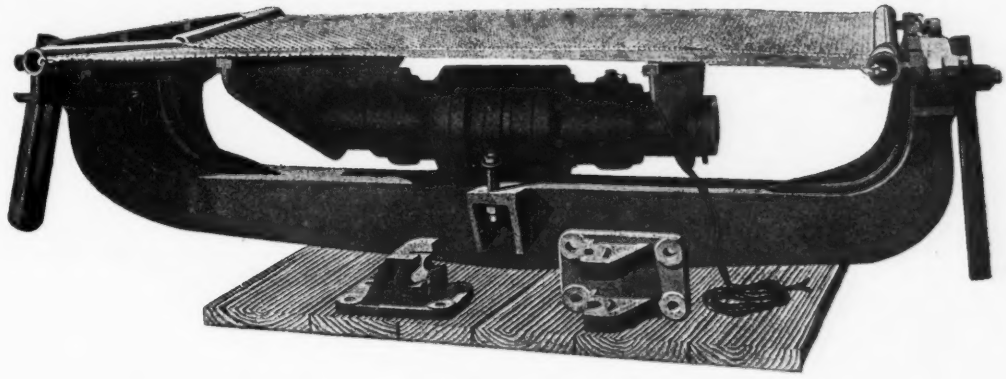
ATLAS
EXPLOSIVES
for Every Purpose

For the Screening of Any Granular or Crystalline Material—

MITCHELL ELECTRIC VIBRATING SCREEN



The feature which first drew marked attention to the Mitchell Electric Vibrating Screen and distinguished it strikingly from all other types was the fact that—

It forces the meshes up into the material 3600 times a minute with an impact of 500 to 1000 pounds.

In the year that has elapsed since the Mitchell was first introduced, it has proved another thing of prime importance—

That it can maintain this remarkable frequency of vibration and tremendous power in the handling of any crystalline or granular material, coarse or fine, wet or dry.

The conclusive evidence of this fact is that the Mitchell is now successfully operating in seven different industries, handling coal, slag, sand, gravel, ore, salt, and fertilizer.

The Stimpson Equipment Company, one of the largest distributors of mining and milling machinery in the West, stands squarely behind the Mitchell in every respect. And users of the Mitchell may count upon the fullest co-operation from our Service Department, in which are employed men of broad experience in the field of screening.

We want you to know both the Mitchell Screen and the company behind it. It will be a pleasure to furnish you complete information

Stimpson Equipment Company

315 Felt Bldg. **Salt Lake City, Utah**

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The Dual Valve principle produces greatly increased power, a surprising operating economy and a surpassing performance.

INCREASED valve area facilitates the intake and exhaust of gas while the double ignition assures complete combustion—delivering ***the full power*** of the explosion and ***saving gasoline.*** It effects important saving in operation and maintenance and increased efficiency.

OTHER advantages produced include accessibility to quick repairs and easy operation—both vital to time-saving and reduction of labor costs.

This has been accomplished without sacrifice of durability, long life or continuous operation—pre-dominant Pierce-Arrow characteristics.

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48 of the FIRST FIFTY trucks still running after 9 years' service.

Delivers more work in a given time.

Loses less time on the job and off the job.

Costs less to operate and less to maintain.

Lasts longer, depreciates less, commands a higher resale price.

THE PIERCE-ARROW MOTOR CAR COMPANY, BUFFALO, N. Y.

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AIR-SEPARATING
SYSTEM
CHICAGO-U.S.A

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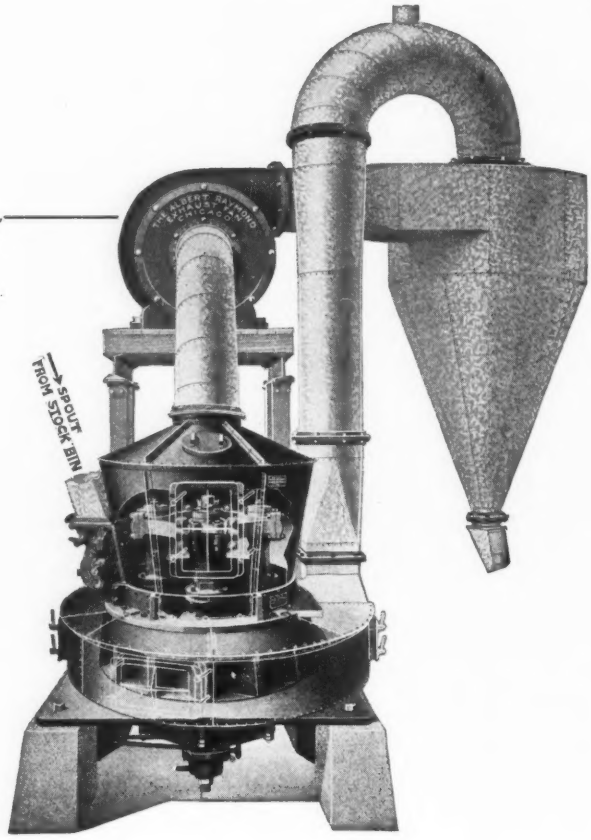

Raymond Roller Mills and Automatic Pulverizers Equipped

with Air-Separation are used to reduce so many materials and in so many diversified industries that it is difficult to cite a sufficiently general case to illustrate to every one having a grinding problem, that the Raymond System will give the results desired and with an economy that can be reached in no other way.

If you have a grinding problem of any kind what-so-ever, write us your requirements as our engineers will gladly give you the benefit of our forty years' experience in the grinding field.

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RAYMOND BROS. IMPACT PULVERIZER CO.

1301 North Branch Street **Chicago, Ill.**

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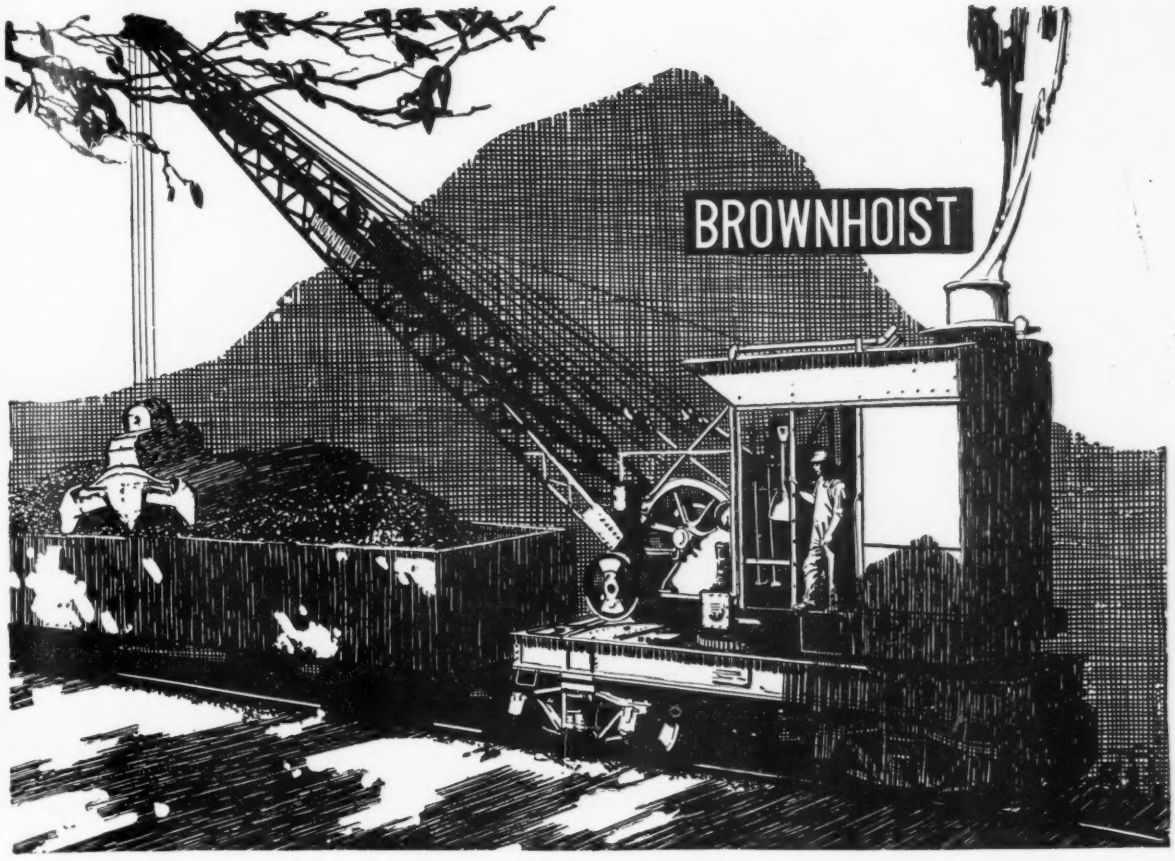

Business needs more cars and you can help get them

Cars are very scarce now. And the car builders cannot produce enough to give us any material relief for some time yet. You play a certain part in the nation's business and whatever you may do to relieve the car situation will be of some help.

There is only one way in which this serious situation can be improved, and that is for all shippers and receivers of freight to use the cars more efficiently. See that your cars are unloaded as soon as received and then reloaded immediately, or if you have no outgoing freight that day, turn the car back to the road. And see that the loading and unloading are done as rapidly as possible.

A Brownhoist Locomotive Crane loads and unloads cars rapidly. If you can use a locomotive crane profitably, then buy it. We offer our services to determine whether it would be a paying proposition for you.

Write for Catalog K which shows how Brownhoist Cranes are used.

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Products Include

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Grab Buckets.
Drag-line Buckets.
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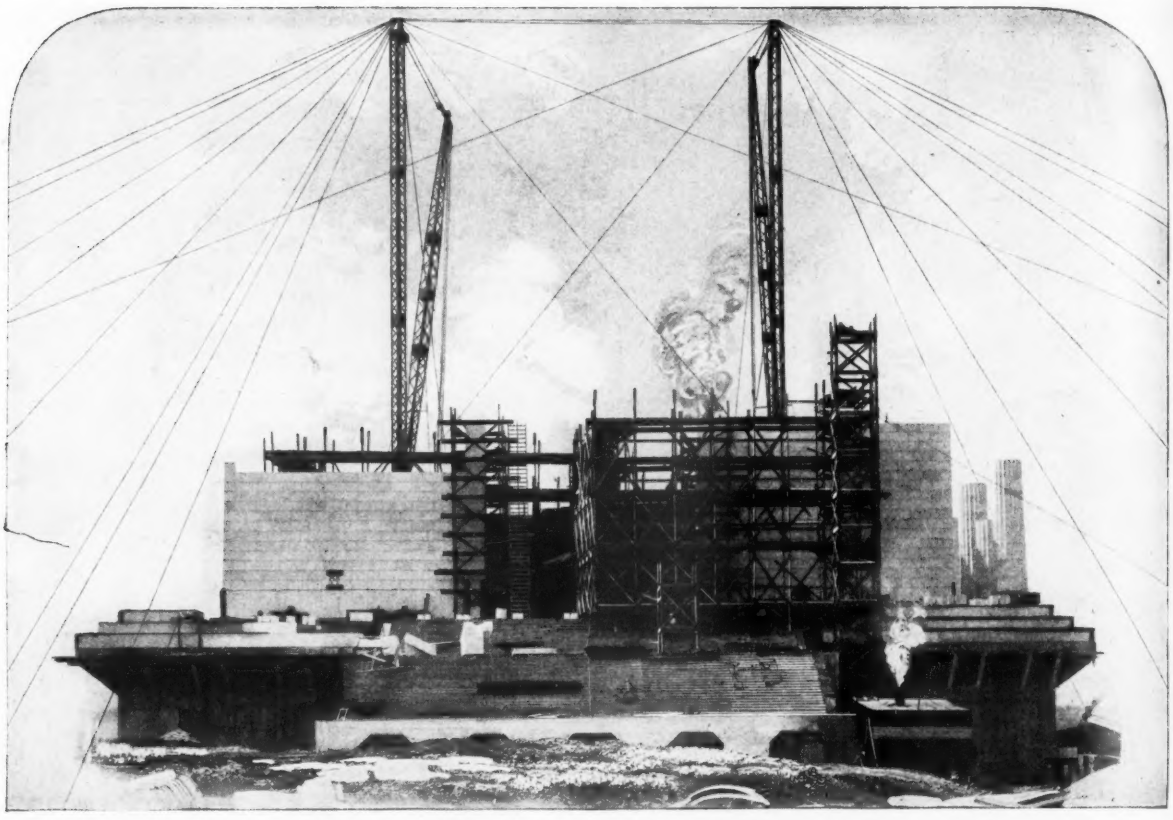

"The Derrick Hoisted It Without a Groan a Hundred Feet from Where It Had Lain"

A newspaper correspondent after watching an "AMERICAN" Steel Derrick hoist the 17-ton cornice of the Lincoln Memorial into place wrote that to his paper.

The above illustration shows the two tall "AMERICAN" Steel Derricks bought by Geo. A. Fuller & Co., the contractors, especially for this job because they knew "AMERICAN" Derricks could be depended upon to hoist and place the costly and weighty marble blocks, speedily and safely.

Many of the best known and most successful contractors place implicit trust in "AMERICAN" equipment. Experience has shown them that "AMERICAN" stands for dependability and that their "AMERICAN" machine will stand up under the hardest work and abuse.

No matter where you are an "AMERICAN" representative can reach you in twenty-four hours.

"Give me where I may stand and I will move the world."

American Hoist & Derrick Co.

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Builders of "AMERICAN"

Hoisting Engines	Locomotive Cranes	Sugar Cane Machinery
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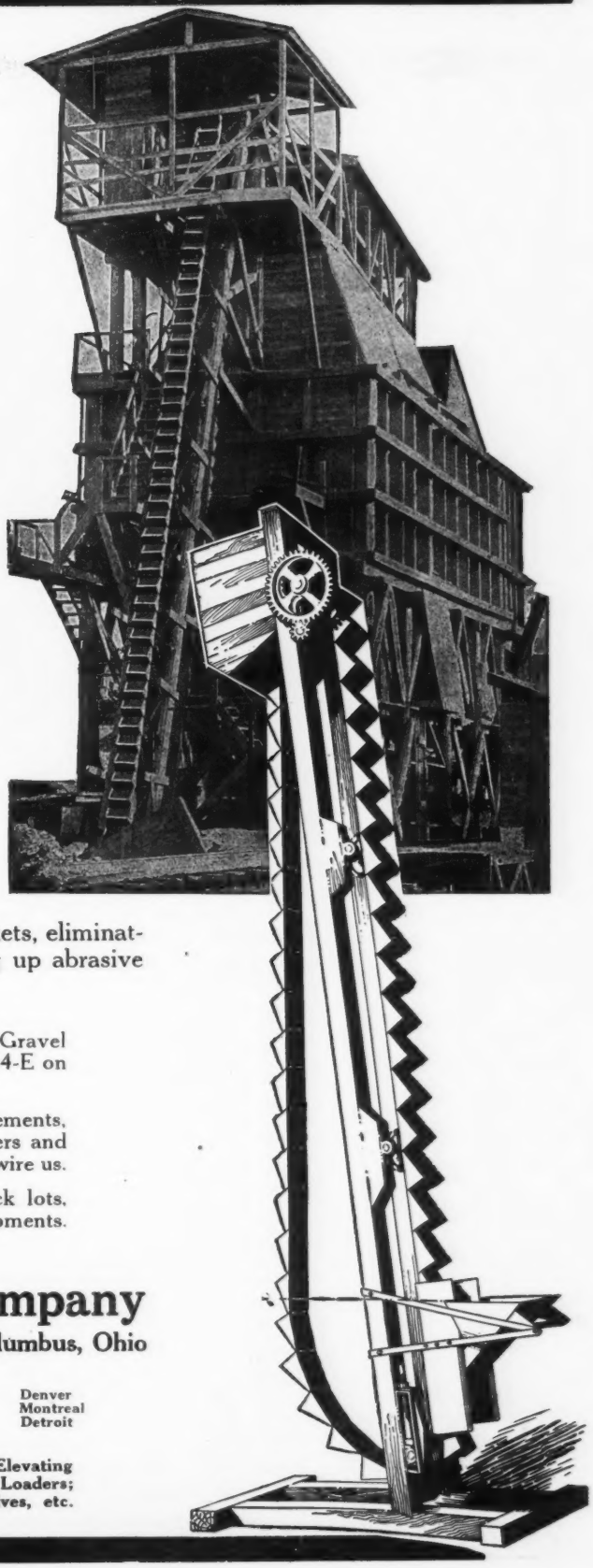
A Typical Application of Jeffrey Bucket Elevators

For Handling Crushed Stone, Sand, Gravel, Etc.



Here a Pennsylvania Contracting Company is handling stone from their gyratory crusher by means of a Jeffrey Bucket Elevator to a revolving screen which distributes the screened product to overhead bins.

Because of its slow speed the continuous bucket elevator is particularly adapted to the handling of broken stone, as the buckets being continuous, the material can be spouted directly into the buckets, eliminating the excessive wear incident to scooping up abrasive material in a boot.

Every Contractor, Engineer or Sand and Gravel Company should have our Catalog No. 244-E on Standard Bucket Elevators.

To order an elevator to suit your requirements, all you have to do is to select the numbers and feet centers from this catalog and write or wire us.

These elevators are manufactured in stock lots, which means lower costs and quicker shipments.

The Jeffrey Mfg. Company

935 North Fourth Street Columbus, Ohio

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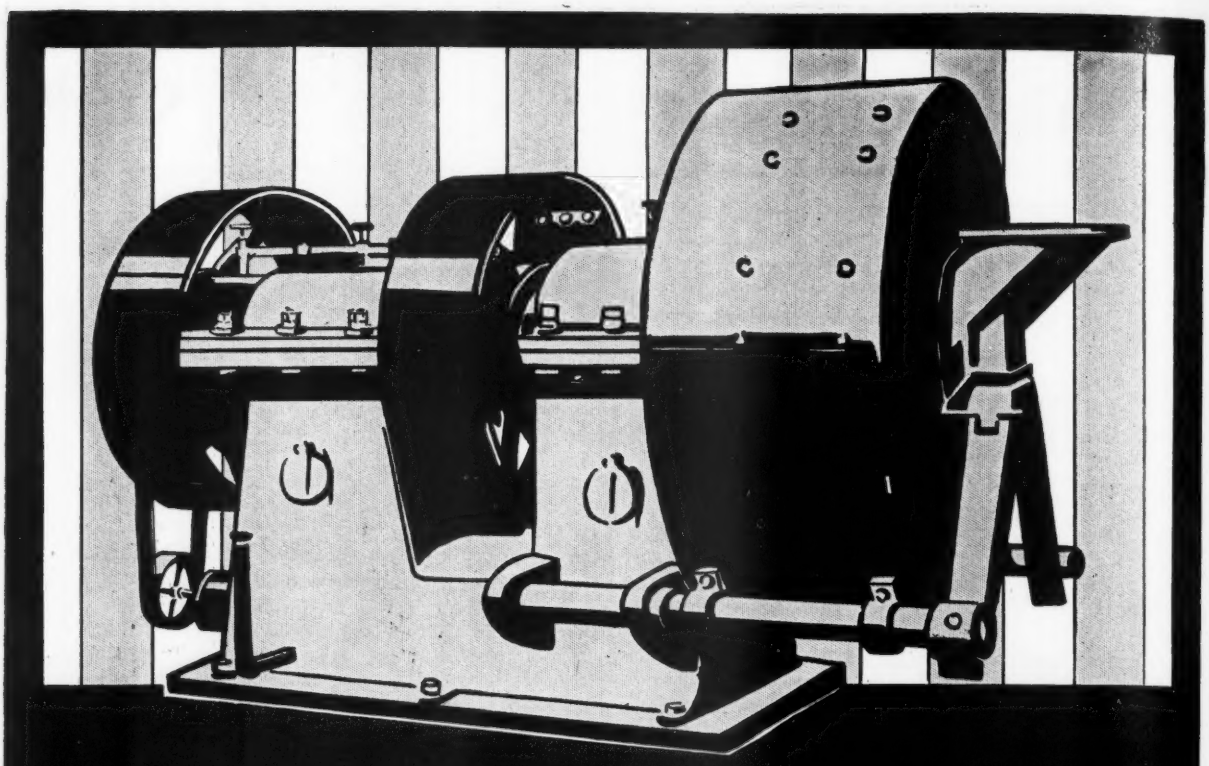
Manufacturers of Pulverizing, Conveying and Elevating Machinery; Chains; Sprockets; Self-Propelling Loaders; Electric Trolley and Storage Battery Locomotives, etc.



SYMONS DISC CRUSHERS

Whether it be one machine or a complete plant, we want the opportunity of figuring with you. Our engineers are at your service in the design of your plant and are in a position to go into the smallest detail of the arrangement of your reduction equipment.

Symons Horizontal Disc Crushers as Intermediate Breakers

Gyratory and Jaw Crushers for Initial Breakers

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DUPLEX TRUCKS

BUILT FOR BUSINESS

Is Transportation a Problem In *Your* Business, *Too?*

If It Is, Read This. It is Published in the Desire to be of Help in Meeting a Common Problem

HAVE you ever thought as seriously as you should of the motor truck in connection with your transportation problem?

Not necessarily of the truck *instead* of the railroads, but of the truck *in addition* to the railroads.

With the average freight car travelling only *25 miles per day* business is slowed up in spite of itself.

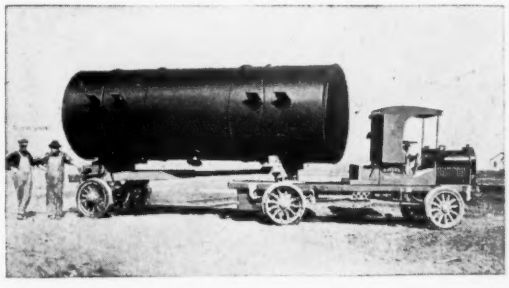
Here is a big field—big with real and potential aid in helping you to do business *without hindrance* and on terms of practical economy.

Now, perhaps, you say that this won't work out. But wait. *It is working out right now.*

Perhaps your observation or your experience has been with the *wrong kind* of truck. Nine times out of ten, so-called trucking disappointments have been remedied by *using the right kind of truck.*

Maybe you want facts. If you do—write us and we will give you real facts about Duplex Trucks —the famous Duplex 4-Wheel Drive, known everywhere as "America's Leading Heavy Duty Truck"; and also some real facts about the wonderful Duplex Limited—the High Speed, Pneumatic Tired Truck that can really haul 3000 to 5000 pounds at high speed over roads as they are.

Read the following and see if it doesn't seem reasonable to believe that these Duplex Trucks are worth knowing about. Write—and do it today.



The Duplex 4-Wheel Drive 3½-Tons Capacity

A Wonderful Truck for Economical Heavy Hauling

IF you have a heavy hauling problem and do not already know the Duplex 4-Wheel Drive, talk to the Duplex dealer and let him give you the facts at first hand.

The Duplex Truck Company is the originator of the 4-Wheel Drive principle and today its most successful exponent.

There is pull and power in every wheel—and the Duplex 4-Wheel Drive keeps going under conditions that are simply impossible for any rear wheel drive trucks.

The Duplex 4-Wheel Drive is setting new records of truck efficiency for Lumber and Logging Companies; Road Builders; Oil Companies; Coal Companies; Mining Companies; Grocery Companies; Trucking Contractors—in fact in all lines where there are heavy loads to be hauled.

The point is the Duplex 4-Wheel Drive is daily proving to be a very *economical truck* for hundreds of owners who used to say it was too big for their needs.

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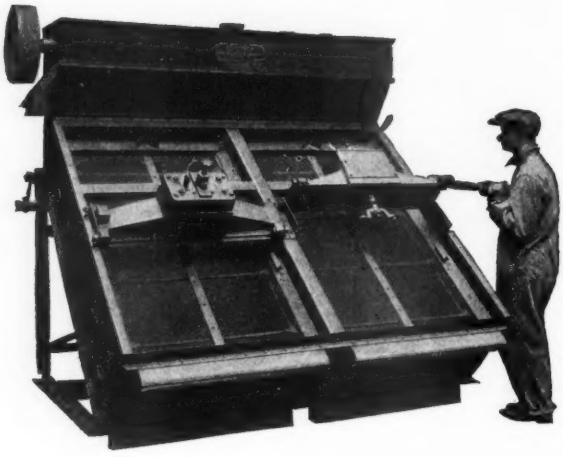
Vibrator on top of screen, accessible for adjusting intensity of screen vibration.



Vibrator "tilted" back to remove screens

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Free from contact with material

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Furthermore, the HUM-MER Electro-Magnetic Vibrators require absolutely no lubrication!

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Write for HUM-MER Catalogue No. R-42

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Rock Products

Vol. XXIII | Chicago, October 9, 1920 | No. 21

Plant of the Central Sand and Gravel Company, Seattle

Hydraulic Mining and Conveying

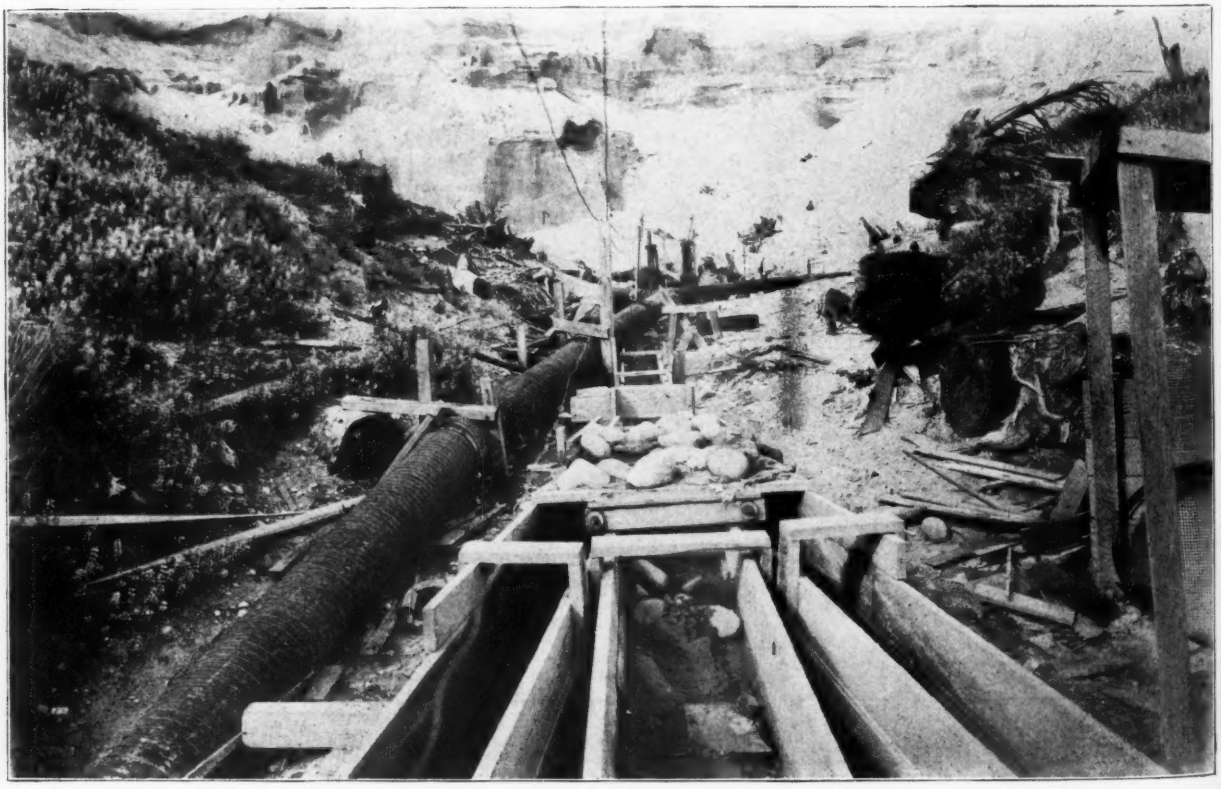
THE VIEWS herewith illustrate the sand and gravel deposit and plant of the Central Sand and Gravel Co. of Seattle, Wash. As will be seen the operation is very similar to that of the Pioneer Sand and Gravel Co. of the same city, which has been described in a previous issue of ROCK PRODUCTS.

The Central company has the advantage of a supply considerably nearer the city than that of the Pioneer company, for the former has a bank of huge proportions only about 10 miles from its city docks, and only a little beyond the harbor limits of Seattle, on Puget Sound.

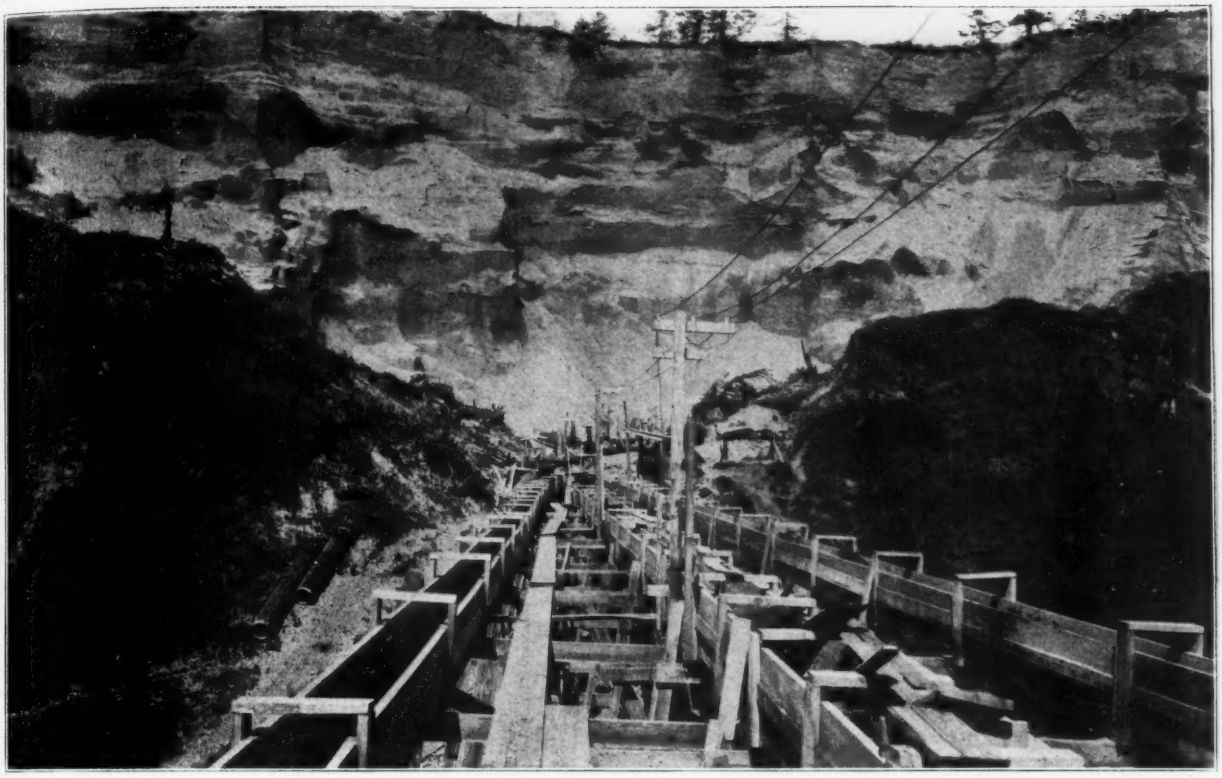
The method of mining varies from that of the Pioneer Sand and Gravel Co., described in ROCK PRODUCTS, September 25, in

Sand and gravel deposit of the Central Sand and Gravel Co., Seattle, Wash.

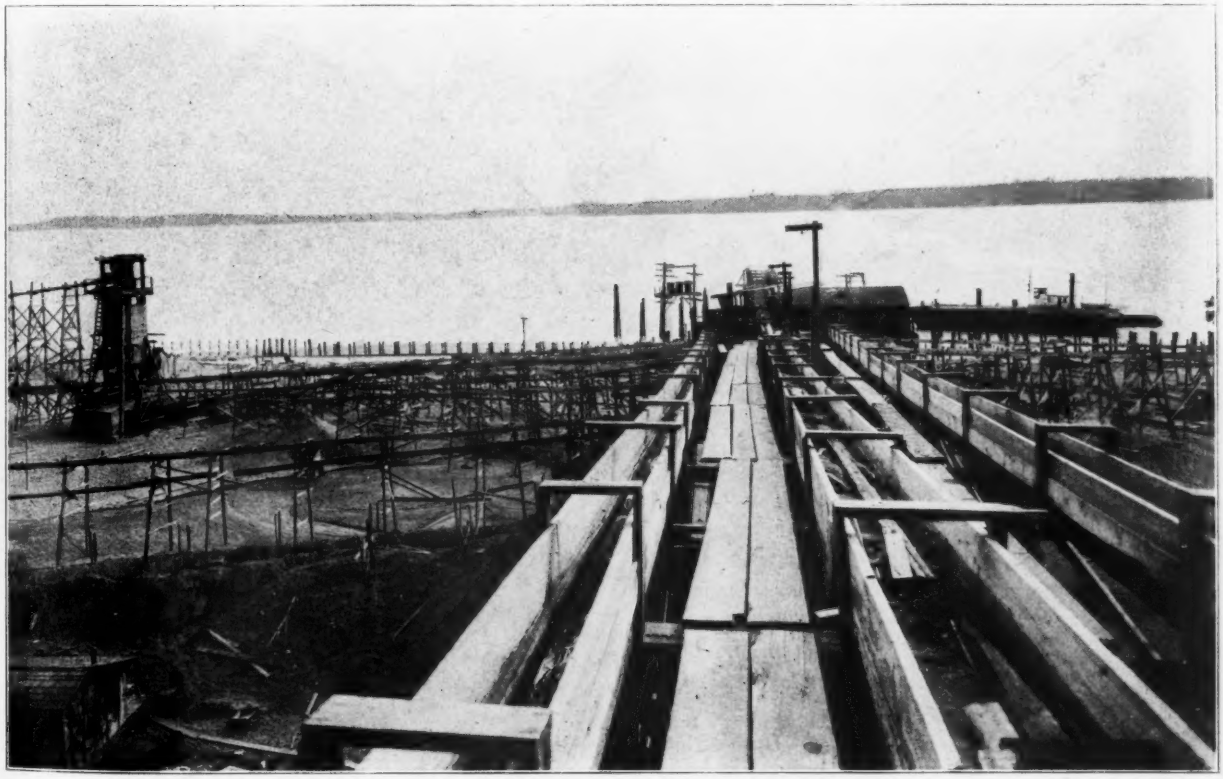
Close-up view of bank showing hydraulic monitor at work



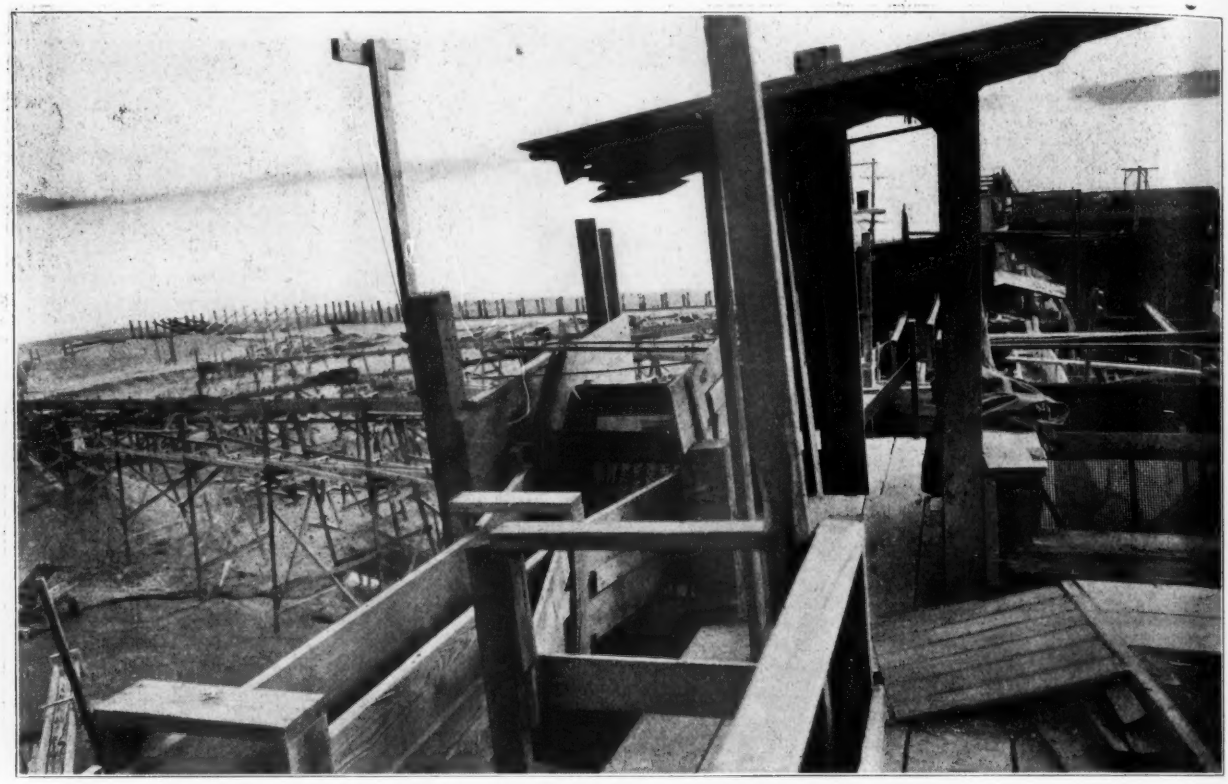
The bank from below showing wood-stave water main and flumes



View of the three flumes from the bank of the screening plant

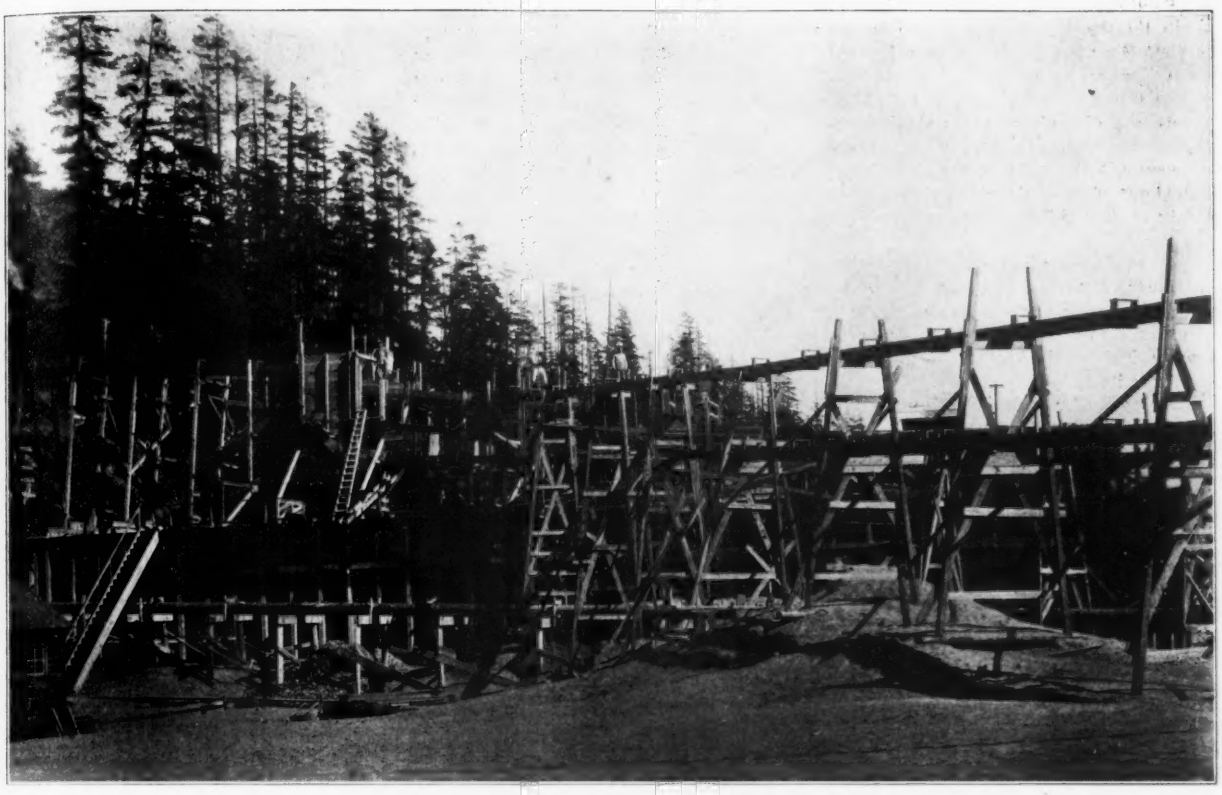


The screening plant from the head of the three flumes

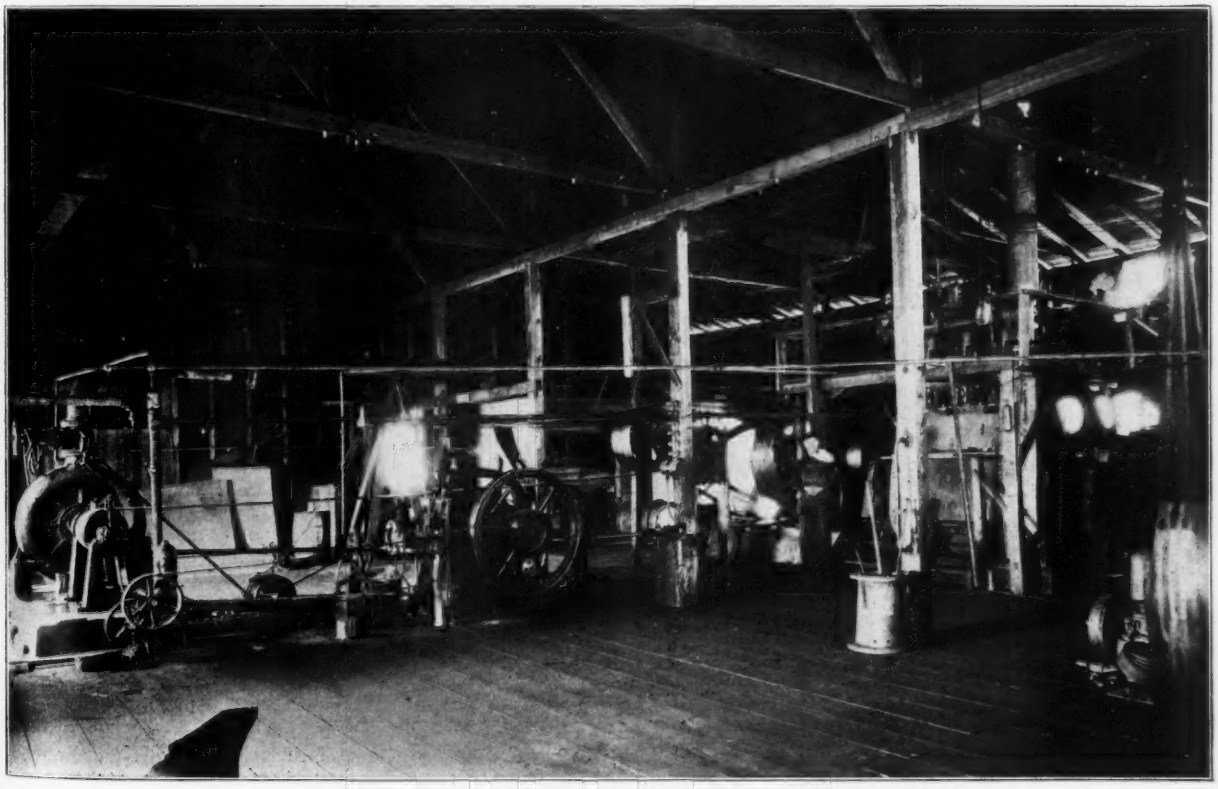


The first screen in the flume—bar screen for removing over-size

The plant from the water front showing relative height of plant and gravel deposit



Another view of the plant from the beach level



The pumping plant—Note gas engines used for power exclusively

using one large nozzle or monitor instead of the two smaller nozzles. Also in this case wood-stave pipe are extensively used for water mains instead of steel pipe. By using salt water it is claimed that the wood-stave pipe gives longer service.

The sluiceways, or flumes, are of the same general character, as the views herewith show. One of the views shows some old band-saw blades, which are used to line the flumes.

The screening plant varies from that previously described in being even more simple in design and operation. Instead of using a rotary grizzly, at this plant a gravity inclined bar-screen is placed in the flume itself.

The material which fails to pass this grizzly is diverted to a special bin, the first of a series which extend longitudinally under the flume. Following the bar screen or grizzly is a finer screen (⅜-in.) to remove all the gravel. This material is diverted to an inclined screen and chute combined, where first the roofing (½-in.) gravel is removed and falls into its bin (the second from the end) and then the fine gravel (1-in. and less) is removed and sent to its bin (the third from the end), while the rejections of this plate screen pass over into the coarse gravel bin, which contains all gravel from 1-in. up to that rejected at the initial grizzly (3-in.)

The incoming flume continues beyond the grizzly and the ⅜-in. sand screen extends on over the sand bins. There is another screen (¼-in.) about half way of the length of this box, where the coarse sand is caught and deflected to a sand-settling tank below. This is an ordinary rectangular overflow tank provided with bottom spigots to draw off the sand as fast as it accumulates, while the overflow passes over to adjoining fine-sand settling tank. The end of the flume also discharges into this tank, and under it is the fine sand bin. The fine sand bin is the last of the row of six bins, extending under the flume.

The plant is really in triplicate, the incoming flume branching into a Y and three parallel flumes, which run down on each side and one in the center of the double row of bins. By means of a steel deflector a short distance above the Y in the flume, the current with its load of material may be diverted to one or both of the plant flumes. The crotch of the Y where the greatest wear comes is protected by a railroad rail, placed vertically.

This plant has no railway connection. All its shipments are by barge to the Seattle water front. The general manager of the Central Sand and Gravel Co. is H. V. Bogert.

Potash By-Product of Illinois Cement

POTASH which can be used as a fertilizer can now be obtained as a by-product in the making of cement from Illinois shale. These shales occur in at least two localities in Illinois, where they contain 5 per cent or more potash. Those which crop out in several places near Jonesboro in Union County are available for the manufacture of portland cement.

By using this material in the making of cement and then applying the known methods of potash recovery, 5.3 per cent of potash, representing 70 to 80 cents per bbl. of cement, can be obtained. Shale from Dixon, Lee County, contains 5.8 per cent of potash, which is held for the most part in a more stable condition than that in the southern Illinois shale.

The Price Policy of the German Potash Syndicate

AT A RECENT meeting of the stockholders of the Potash Syndicate at Wintershall, the price policy of the syndicate's board of directors was attacked. It was pointed out that because of the high prices now demanded recent transactions with America have practically failed. According to a report of this meeting, printed in the Industrie und Handels Zeitung of August 25, the stockholders demanded that, in order to be sure of regular export orders, prices should be reduced especially for America. This paper says:

The potash recently offered to the United States was set at $150 as against a price of $65 before the war. In opposition to this policy, England a year ago received 35,000 tons of potash at $76 a ton. The Americans, not willing to pay this high price, confined their orders to a smaller amount of potash salts. In 1913, the United States took over 2,000,000 tons of potash, whereas the total deliveries of the syndicate in the first half of the current year amounted to not more than 92,000 tons. During this period the Alsace-Lorraine potash plants sold 34,000 tons. It was suggested at the meeting that no standard price be stipulated but that each country be treated individually. The home prices, which are now five times the pre-war price, it was claimed, are based on the cost of production and the stockholders voted that domestic prices should be kept where they are.—Consul Frederick Simpich, attached to American Mission, Berlin, Germany.

Oil Shale in Esthonia

THE USE of oil shale in Esthonia is increasing rapidly according to a bulletin issued by the Guaranty Trust Co. The Esthonian Ministry of Commerce sells several thousand poods every day, and receives about 500 orders of about 225 poods each. The small purchasers burn the shale in their dwellings, and several large factories also have adopted this fuel. Experiments in heating ships' boilers with oil shale are planned.

Permeability of Concrete

PRELIMINARY TESTS are being made by the Bureau of Standards, Washington, D. C., of a new apparatus for determining the rate of penetration of water through concrete and other permeable materials. The apparatus used is so constructed that it is not necessary to mold the test piece in any particular shape, but any slab having one fairly smooth face may be tested. Only a few seconds are required for placing and adjusting the test specimen. This will permit specimens to be cut from walls or other portions of structures for tests. Tests so far made, while more in the nature of a try-out of the apparatus than the materials used, have furnished some rather interesting results.

In the following table the results of tests on samples of building stones from various quarries, as well as on some mortar and concrete specimens, are shown. The specimens varied from 1¼ to 2½ in. in thickness and pressure was applied over an area of 25 sq. in.

These results appear to bear out conclusions previously drawn in the bureau's investigation of the durability of concrete in alkali soils that there is no apparent relation between absorption and permeability.

While considerable work must be done to standardize the method of making the permeability tests, it appears that this apparatus will assist in studying with a minimum of effort an important characteristic of concretes which has in the past been generally ignored, due to lack of suitable apparatus.

Test Specimen	Absorption in 24 Hrs.	Thickness Ins.	Water Pressure Lbs.	Time Required for Penetration Through Wall
Limestone 50	5.80%	1 5/8	60	10 1/2 minutes
Limestone 7E	3.10%	1 5/16	60	11 minutes
Limestone 8907	4.40%	1 5/8	60	19 minutes
Limestone 9c	4.60%	1 5/8	60	2 2/3 minutes
Limestone 14F	3.81%	1 5/8	60	20 seconds
Limestone 5G	3.48%	1 1/4	60	1 1/2 minutes
Sandstone 1:6 Portland..	5.56%	2 1/2	60	10 seconds
Cement Mortar 1:1 1/2:2	7.8 %	2	60	3 1/2 hours
Concrete	5.8 %	2	60	24 hours*

* Did not fail in 24 hours when broken through water had penetrated only 1/2 in.

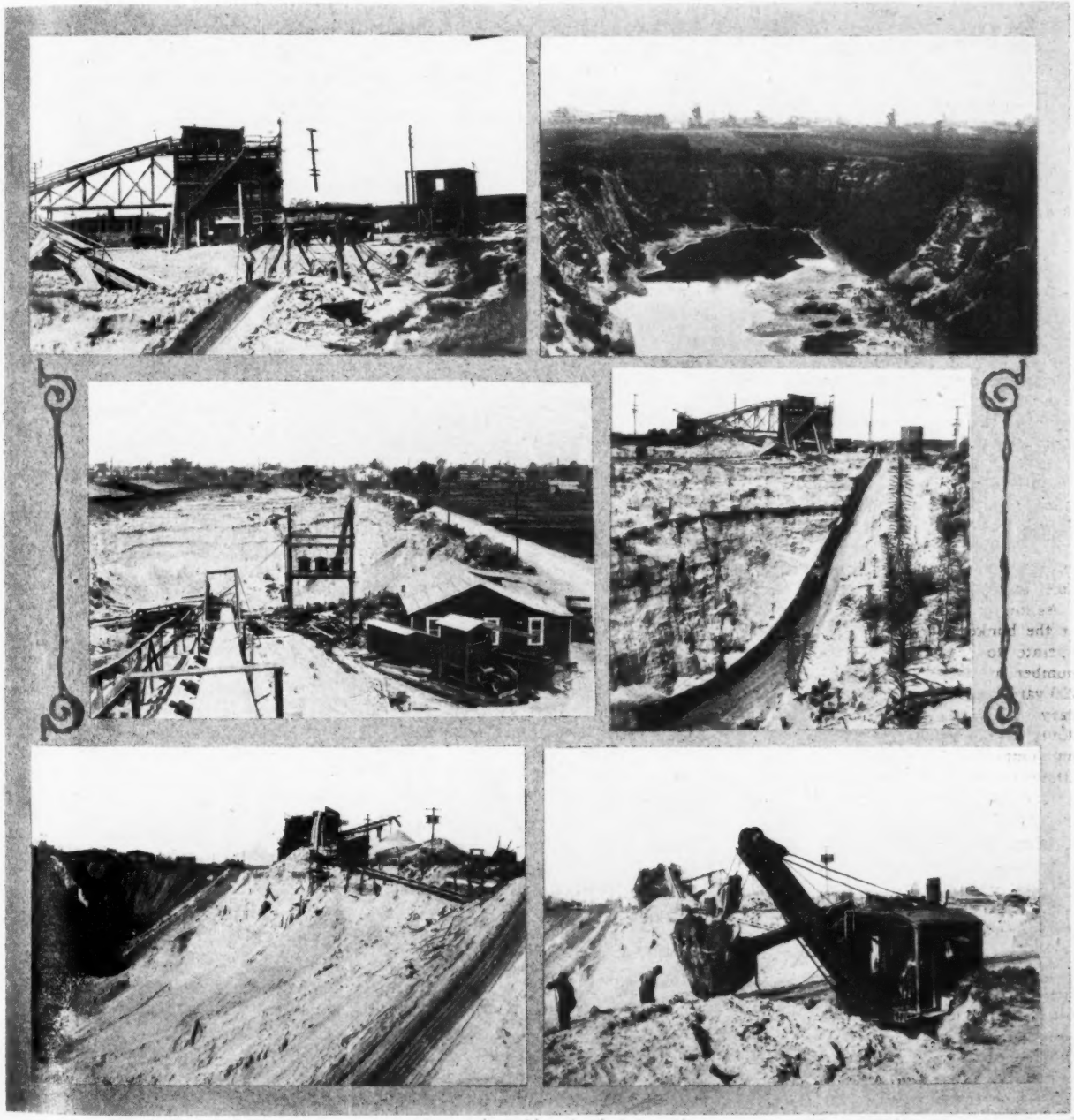
Southern California Gravel Plant

History and Growth of the Consumers' Rock and Gravel Co. of Los Angeles—Unusual Dragline Operation

By George Gautier

IN 1912, when the Consumers' Rock & Gravel Co. built its plant, sand commanded exactly 20 cents a yard f. o. b. bunkers in Los Angeles. A million tons of material lay in the dry bed of the Los Angeles River and could be had for the taking. That was in the day of the horse-drawn vehicle and men with one and two-yard wagons and trailers dug hundreds of yards a day from the river bed.

When the Consumers' company built its plant these small sand merchants figured it would be about a "stand off" to pay 20 cents a yard for bunker material or to shovel it from the river bed. They



Views of the sand and gravel plant of the Consumers Rock and Gravel Co., Los Angeles, California

would not pay more because labor was cheap in those days and a husky teamster could shovel his yard load in as few as 20 minutes, if he were pressed.

Good Reason to Operate Economically

It is obvious that if the Consumers' company were to operate successfully, it must operate efficiently and economically, for even in those days the cost of production could not be much less than 20 cents a yard. Almost eight years have passed since the inception of this pioneer plant, and the fact that the company now operates a total of five plants in the vicinity of Los Angeles attests to its success. In fact, the original Consumers' plant is considered among rock and gravel operators of Southern California as a model of efficiency and simplicity.

In the first days of its history, the company really faced a serious problem as its clientele was composed entirely of teamsters and dump wagon contractors. The company could not demand more than the teamster would pay because there was virtually millions of tons of material in the river bed which could be had for the shoveling.

It is probable the advent of the motor truck as much as anything else contributed to the success of the company. The dump truck, hardly had it appeared, proved indispensable. In a surprisingly short time motor trucks entirely replaced the horse-drawn vehicle in Los Angeles. One of the best known facts of motor truck operation is that money can't be made with trucks standing idle—not even for the short time it might take two or three men to shovel on a load of gravel. Truck owners could pay more for material at the bunkers because they could not afford to lose time and because they were able to make more and faster deliveries.

As long as horse-drawn vehicles loaded at the bunkers the plant was unable to operate to capacity as only a limited number of wagons could be loaded. A 200-yard day was considered extraordinary. As soon, however, as hauling was done exclusively by trucks the plant's output jumped to 750 yards a day. And, to attain this increase in production, only a few minor changes in machinery were necessary.

Scheme of Operation

The flow-sheet of the plant is comparatively simple. The aggregate, rock and sand in proportion of 30:70, respectively, is excavated from a pit. The deposit lies beneath an overburden of from 7 to 10 ft. of loam, which must be stripped before the material is available. Stripping is done with a steam shovel, and it has been customary to strip areas covering six acres at a time before the material is excavated.

The aggregate is taken from the pit to a hopper by a 3-yd. dragline bucket operated by a 100-h. p. electric hoist. An automatic feeder at the hopper loads a 30-in. conveyor belt, which conveys the material up a 200-ft. incline to the top of the bunkers. The belt discharges the material into a cylindrical screen, which grades it as follows: Fine sand, coarse sand, 1-in. and ½-in. pebbles and oversize. The graded product falls into bins of 100 yds. capacity from which trucks are loaded.

Oversize drops down a chute into a large boulder bin. From this bin boulders and oversize are discharged into a No. 5 gyratory crusher, which crushes the rock into ¾-in. and 1½-in. and oversize. From the crusher a continuous chain bucket elevator conveys the crushed rock to another screen on top of the bunkers which separates the ¾-in. from the 1½-in. rock. Oversize is discharged from the screen, and by means of a chute is brought back to the crusher to be recrushed, while the finer material goes to the sand and gravel screen.

Made to Handle Dry Material Only

The design and equipment of the plant are particularly fitted for the conditions under which the plant operates. Under almost any other conditions the plant would be anything but a success. If it were to excavate from a river, or if it were to handle wet material, it would prove a failure. This has amply been proved when the pit had reached a depth of 104 ft. and water was struck. In winter the water rose several feet, and an attempt was made to continue to depth. The wet sand, however, slopped over the belts and ground down wearing parts of gears and pulleys. It also clogged the screens so effectively that rock bins filled with sand, while the sand bins remained empty. This, of course, ruined the finished products, and excavating at depth had to be discontinued as long as water was present.

From the bottom of the pit to the top of the bunkers, the aggregate is handled, but by two different machines; the dragline bucket and the conveyor belt. The belt practically never gets out of order. In rare instances the pulling cable on the drag-line bucket breaks, but it requires only a splicing job to make it as good as new again.

A Four-Man Operation

One of the remarkable features of the plant is that only four men are required to operate it. As a matter of fact, two men are capable of operating the plant and placing 750 yards in the bunkers in an eight-hour day. Further, if it came to a showdown, the plant could be operated for a limited time by a single man—the hoistman. This was demonstrated on the night of February 21, this year. On the evening of February 21, after working hours, the plant superintendent received a rush call from the contractor building the famous Los Angeles Speedway at Beverly Hills. The contractor had to have 250 yards of sand that night, as the races were to be held at 2 o'clock the following afternoon. The contractor had finished his job except for scattering the 250 yards of sand over a large area of freshly oiled ground that was to serve as parking space for automobiles. The contractor simply had to have the sand to cover the oil. He finally convinced the superintendent. But the superintendent could not get his crew together that night. Single-handed he tackled the job. He started the conveyor belt and screen motors, and then got the drag-line bucket into operation. Fortunately, that night, no accident occurred, and at the end of four hours the superintendent switched the current off from the hoist motor as the last truck had been loaded.

Four men, however, are regularly kept on the payroll because there is always a certain amount of extra work to be done as well as emergencies to meet. The hoistman is by far the most important employee at the plant. Without him the aggregate could not, of course, be brought up to the hopper, but once at the hopper it can be, and is, conveyed to the top of the bunkers and screened into bins automatically. In addition to the hoistman there is an employee who loads trucks and watches the crusher. Another man is in charge of the conveyor belt and the screens. He is also sent down into the pit occasionally to "shoot" the bank.

"Shooting the Bank"

Shooting the bank is somewhat dangerous and the man who does it must have the "feel" for landslides, as they are of frequent occurrence, often coming down without provocation. It occasionally happens that they occur when the drag bucket is at the bottom of the pit. Of course, the bucket is buried under hundreds of tons of sand and rock, and it often takes several men with horses and fresnos the best part of a day to dig it out. In addition to these three men, a fourth is employed whose duties are general.

All machinery is operated by electric power. The plant is equipped with five motors which develop a total of 200 h. p. Current is reduced at the transformers from 1500 volts to 220. The largest motor on the plant is 100 h. p. This runs the hoist. The smallest is of 10 h. p., which drives the chain buckets.

In the eight years that the plant has been in operation more than three-quarters of a million yards of rock and sand have been delivered to buildings and streets of Los Angeles. A total of nearly 12 acres have been excavated from the pit to a depth of about 104 ft. The pit at present is an immense depression nearly 1500 ft. long, 600 ft. wide and 104 ft. deep. In winter, when the water rises, a lake from 10 to 30 ft. deep covers the entire bottom of the pit.

Agricultural Limestone Plant Operating All Year Round

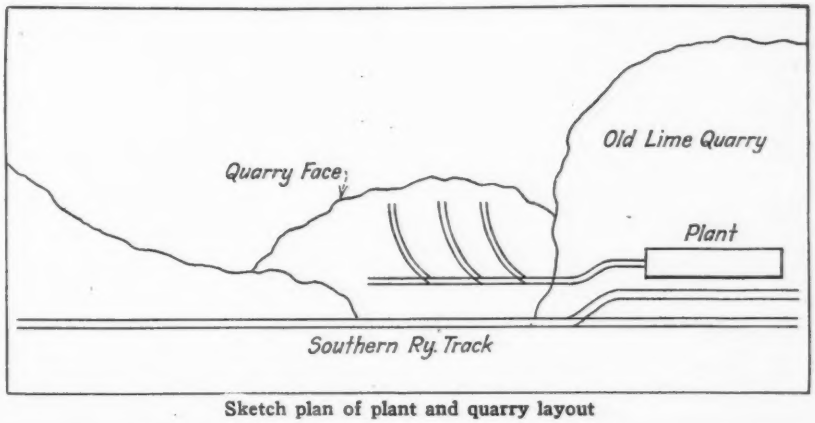
The G. C. Buquo Lime Company, Hot Springs, North Carolina, Provides Storage Facilities for Continuous Operation Notwithstanding Fluctuations in Demand

WHAT IS NOW one of the largest institutions in the country exclusively devoted to the production of pulverized limestone originated as a pot-kiln lime plant. G. C. Buquo, the present general manager and superintendent of this plant, the Buquo Lime Co., Hot Springs, N. C., got his early experience in lime manufacture and agricultural limestone production with the Blue Ridge Lime Co., which is also in this neighborhood.

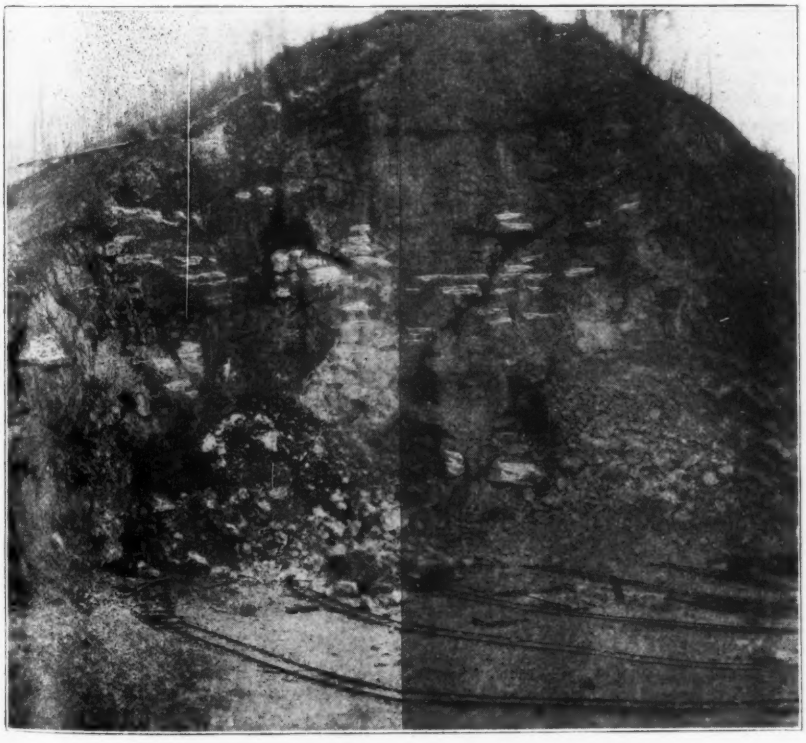
After having scouted around over the country for a suitable deposit to open up for himself, Mr. Buquo learned that the Southern Railroad was driving a line through a solid mountain of lime rock and went to investigate. The deposit proved to be the one which had at a much earlier date been operated for a pot-kiln lime plant, but because of the angle of stratification, had been abandoned as a profitable quarry. Upon analysis the stone was found to run almost a pure dolomite, and so Mr. Buquo concluded to attempt the proposition for himself.

Quarry Attacked from End

Instead of working the deposit from the broadside of the hill as had been the method of attack of the previous operator, this time the quarry was worked from the end. Due advantage was taken of the work that the railroad had done in opening the way for its road. A face of 100 ft. of stone stood perpendicularly



Sketch plan of plant and quarry layout



Quarry of the G. C. Buquo Lime Co., Hot Springs, N. C.

to the main line and at no great distance from the track where passenger trains were passing frequently. It was quite a ticklish proposition to drill and shoot a face so high and so near the track.

The holes were carefully spotted and the charges of dynamite calculated to a nicety of precision so that no stone would be thrown on to the track. The first several cuts were made in benches of a few feet at a time because of the danger of throwing the rock. Shots were made between train times and at only one time was the track covered with rock, and then it was cleared away in two hours before the next train came through.

The disadvantages so encountered were offset by those gained through this mode of attack. First of all there was no expense of opening the quarry, for the railroad had already opened it. Then, the rock was so stratified that by starting at any other part the deposit would have resulted in a face hard to work—that is the face actually exposed was the one at right angles to the stratification and the dip of the ledge.

Some Unusual Features

After several years of successful operation, the American Agricultural Chemical Corporation became interested in the

property and later purchased it, leaving Mr. Buquo as the general manager and superintendent.

Since then the plant has constantly been improved and enlarged until it now stands as the acme of the pulverized agricultural limestone plants of the South. It has a daily capacity of 200 tons of finely ground limestone and unlike most agricultural limestone plants operates the whole year around.

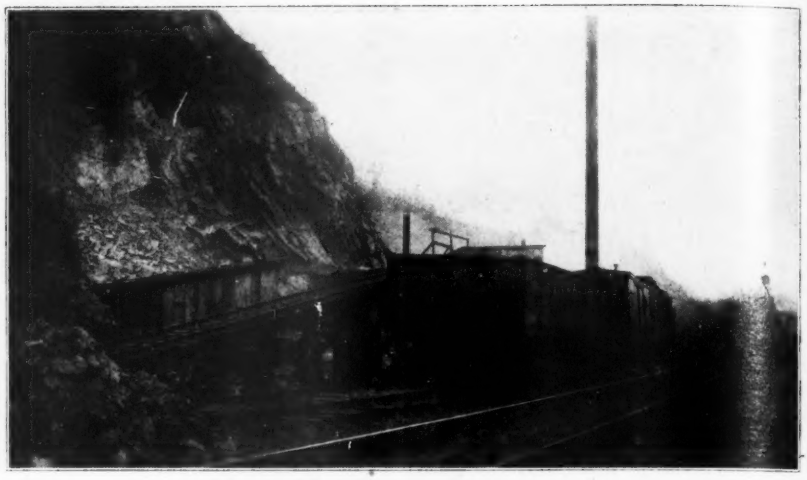
The stone is quarried and loaded by hand in much the same way as at all Southern quarries. But, as Mr. Buquo states: "We believe that this operation enjoys one distinction that seldom comes to anyone and it consists of shooting down 2,000 tons of stone with four sticks of dynamite. This may be hard to force on the average quarryman, but we stand ready to prove it and explain how it was done. We accomplished it with Aetna 40% low freezing dynamite." Mr. Buquo has promised to have his explanation ready for publication soon.

Being a nearly pure dolomite stone, considerable of it is shipped in the size that it comes from the quarry to the manufacturers of epsom salts. For this purpose an incline has been built out at the car siding and the quarry cars are drawn up to the top of an open railway car and side dumped into the cars. The home-made quarry cars, which are of an automatic side-dump type, makes this possible. This car has a bed mounted off center on a shaft, so that it may dump when released from a catch on the opposite side. The dumping side of the quarry car is open so the contents are easily discharged.

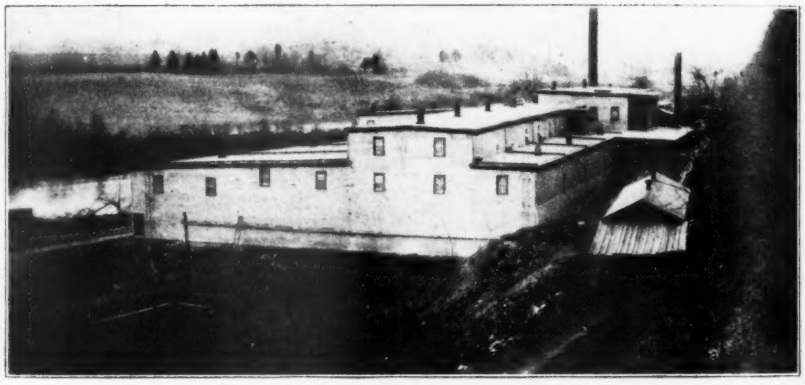
Crushing and Grinding Plant

The stone to be reduced in the mill is delivered to a No. 7½ gyratory crusher where it is reduced to 2-in. size. The crushed stone then passes to a revolving screen having 2-in. perforations. All oversize goes direct to the mill bin, and the material passing through the screen goes to a rotary dryer and comes back to mill bin hot and is mixed with the oversize material. The material then passes to a Bradley "Hercules" pulverizer which reduces it at the rate of 21 to 28 tons per hour, depending upon the nature of the stone being ground.

Extra large production from this mill is obtained on one deposit of the stone quarried, which is a true dolomite running better than 98% carbonates. This stone is very brittle and full of minute fractures. The pulverizer mill gives complete satisfaction even at this capacity and finishes the material in one operation to about a 20-mesh product, according to Mr. Buquo. The material after being finished passes either to cars or to storage.



Loading track for quarry stone



Storage building and grinding mill

Inside of storage building for ground stone

The storage holds around 20,000 tons. This building is of mill construction and has bulkheads of both concrete and wood and is floored with concrete. From this the dust can be reclaimed at the rate of 50 to 60 tons per hour by a motor-driven reclaiming outfit. When operating both mill and reclaimer a car of limestone can be loaded every 30 minutes.

Handling Stored Dust

The finished limestone dust is delivered

from the pulverizer to storage by elevators and a screw conveyor.

A traveling trip is provided for distributing the pulverized limestone over the entire storage space. A conveyor along either side of the space near the ceiling enables the entire storage to be used. During the winter and summer months, this is filled and in the fall and spring, heavy shipments empty it. The accompanying view of the storage was taken in March at a time when it was almost empty.

A drag-line scraper operated by a two-speed electric hoisting machine is used to pull the material over to a hopper. A conveyor belt fed from the hopper elevates the product to the Bates bagging machine on to a bin from which cars are loaded with bulk material by gravity. During the month of February, 187 cars were shipped.

Power Plant

The power plant consists of three return tubular boilers of a total capacity of about 400 h. p. and the grinding and crushing is done by power from a Corliss steam engine of about 350 h. p. There is an electric generating outfit of about 80 h. p. for driving individual motors. One of these motors drives the dryer, another the Bates packer, and still another the reclaiming machine drums.

Slate Industry Picked Up in 1919

Revival of Building Industry Shows Slate Is Still Popular Construction Material

THE VALUE OF THE SLATE sold in the United States in 1919, according to a statement made public by the United States Geological Survey, Department of the Interior, was $5,065,000. This value represents an increase of 26 per cent over the value for 1918, but does not equal the value for 1917, which was $5,749,966.

Roofing Slate

The output of roofing slate, which represents more than half the total value, was 475,000 squares, valued at $3,040,000, an increase of 25 per cent in quantity and of 30 per cent in value over that in 1918, which was 379,817 squares, valued at $2,219,131. The average price per square increased 56 cents—from $5.84 in 1918 to $6.40 in 1919—although several firms reported an increase of $1 a square or more. The demand for roofing slate, which was poor during the first six months of the year, increased later, and notwithstanding the difficulty of obtaining labor the output of nearly all the quarries showed an increase. The roofing-slate quarries in Pennsylvania, which furnish most of the slate sold for roofing, showed an increase of about 30 per cent in quantity and 40 per cent in value. Virginia and Maryland also showed a considerable increase in 1919. The reports from Vermont were less favorable, indicating a gain of not more than 10 per cent.

Mill Stock

The quantity of mill stock sold in 1919 was apparently about the same as in 1918, and its value increased about 5 per cent. Mill stock for sanitary and structural purposes, including grave vaults, was in very little demand until late in the fall, when the rapidly growing demand was all that the producers' working capacity could satisfy. It is predicted that the output of structural slate in 1920 will be greater than in any previous year on account of the renewal of work on many building projects that were held up during the war and also on account of the many new uses that are being made of this slate.

Electric Slate

The sales of slate for electric use decreased in 1919, the cessation of the demand for war material reducing sharply the demand for slate for this purpose.

Blackboards

The quantity of slate sold for blackboards and bulletin boards in 1919 showed a decided increase over that sold in 1918, but the average price showed no considerable increase. The demand was reported to be above the average, and good orders are on hand for shipments in 1920.

School Slates

The demand for school slates was reported to be greater in 1919 than for several years. One producer stated that on account of scarcity of both material and labor it was impossible to fill more than a third of the orders received. The average price per thousand increased about $2 in 1919 and ranged from $10 to $20.

Billiard Tables

The quantity of slate sold for billiard tables increased in 1919, but the average price per square foot was not so large as in 1918, possibly on account of increased sales of rough stock for this purpose.

Slate for Other Uses

A small quantity of slate is sold annually for use in making tombstones, crosswalks, and well covers, and, in small pieces, for embedding in asphalt as material for flat roofs, and the figures given in this report include this slate. They do not include, however, a large quantity of slate granules that are applied to sheets of asphaltic felt for use as roofing material. This material has been marketed for several years, and its production was greatly increased during the war, when large quantities of it were used both by Government and by private builders on many temporary and semi-temporary buildings. This material has grown so greatly in favor that not only slate but ground stone of other kinds has been used in its manufacture, and in 1919 several new quarries were equipped to furnish this material. The stones first and most widely used for this purpose have been red and green slates of New York and Vermont. The slate from a quarry at Provo, Utah, has been used for this purpose for several years, and in 1919 slate quarried at Peach Bottom, Lancaster County, Pa., has been sold in granules. The Survey has received a report that a slate deposit near Tellico Plains, Monroe County, Tenn., has been leased to a company that proposes to develop the property and place crushed slate granules on the market. Though the red and green slates have been most in favor for making this roofing material the gray and black slates would be equally satisfactory if properly used and if given the proper setting. Other stones and minerals that have been used or considered for this purpose are "greenstone" (altered diabase), massive epidote, olivine, and serpentine.

Estimated Increase of Production

No figures showing the value of the slate produced by the several States in 1919 are yet available. A complete report on the subject is in course of preparation by A. T. Coons, to be issued by the Geological Survey later in the year. An increase of about 30 per cent may be expected for Pennsylvania and for Virginia, and 50 per cent for Maryland.

Imports

The imports of slate are negligible. They were valued at $1,024 in 1917, $321 in 1918, and $691 in 1919.

Exports

The roofing slate exported in 1919 was valued at $55,164 and in 1918 at $65,224, a decrease of 15 per cent in 1919.

Slate exported for other purposes than roofing decreased in value from $187,563 in 1918 to $180,344 in 1919.

Crushed Stone Granite Quarry

The Weston and Brooker Company of Columbia, South Carolina, Has One of the Largest Commercial Quarry Operations in the South

FEW GRANITE QUARRIES are operated exclusively for a crushed-stone product. The reason probably is that while granite is a comparatively easy stone to quarry and work in rectangular blocks, it is a very difficult one to quarry and crush for commercial crushed-stone. Also of course one can not operate the same quarry for both dimension and crushed stone, because blasting operations of any extent shatter the entire deposit.

However crushed granite makes an excellent commercial crushed stone for most purposes. The fines of a granite quarry are nearly always marketable because they make an excellent sand, and because they form a very clean grit which has a number of industrial uses.

Probably the most extensive granite quarry operations for exclusively crushed-stone production are those at Columbia, S. C., and in this locality the largest single producer is the Weston and Brooker Co.

Quarry Operation

The quarry of the Weston and Brooker Co. is about 200 ft. deep and the sides are nearly perpendicular for the entire depth of each bench. Quarrying is done in two benches 80 and 120 ft. deep, respectively. Under such conditions the quarry operation does not lend itself readily to the usual methods employed in pit quarries. Consequently the method adopted is the use of a large traveling cableway, to be described further on.

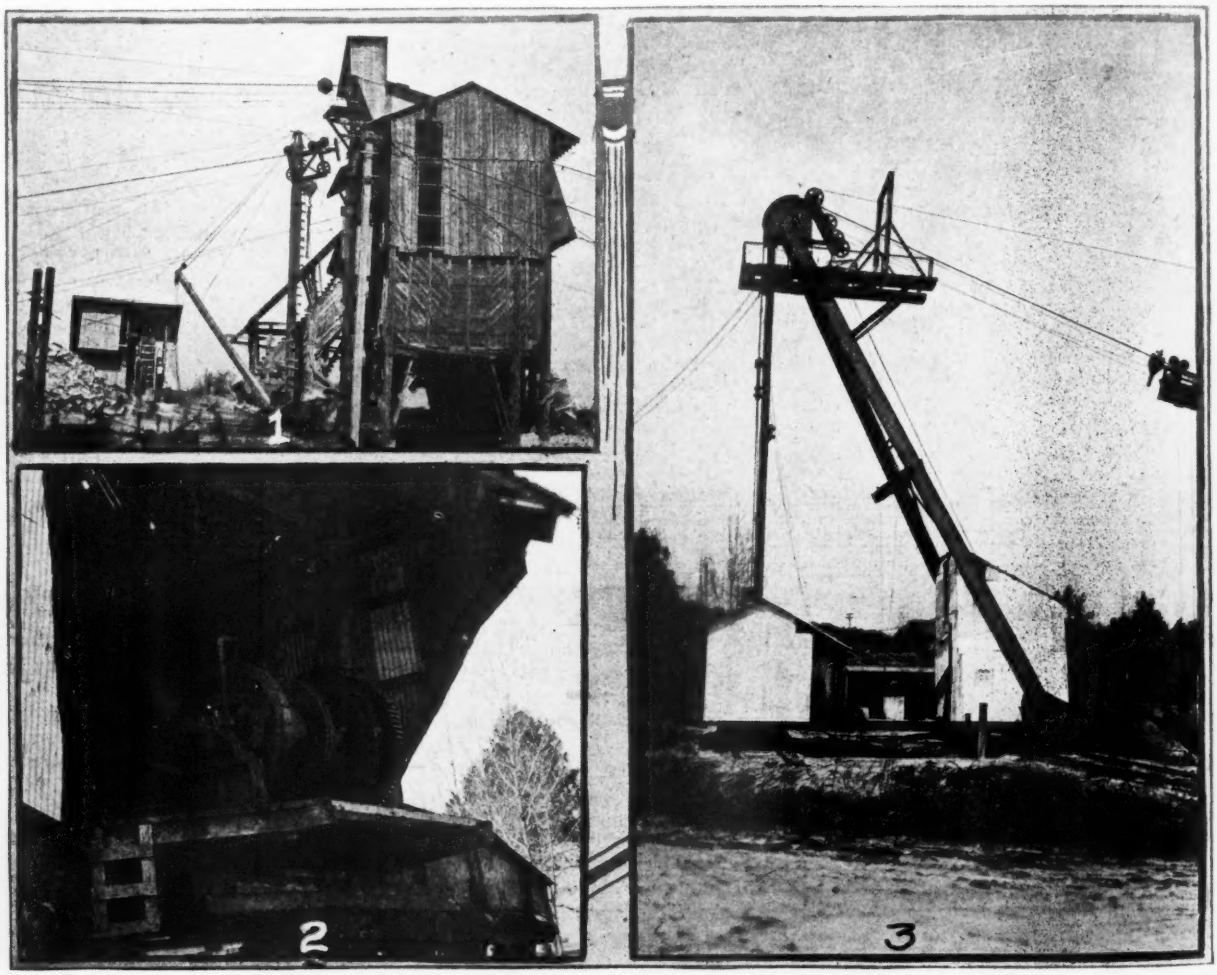
Drilling for blasting is done with well drills and with compressed-air operated tripod drills and compressed-air hand drills. The stone is an extremely hard granite and this is possibly the only operation of its kind in which well drills have been successfully used.

The well-drill holes are made 5¾ in. in diameter and 120 ft. deep. The granite is so hard that it is found impossible to drill except with a solid stem, with the bit and eye welded on.

A 60 per cent dynamite is used for the explosive and several holes are fired simultaneously.

The broken stone in the quarry is loaded into skips by hand. The skips are of special design, made of steel, and hold about 6½ tons. They are open at one end to facilitate dumping.

These skips are transported from the quarry to the crusher by cableway. The main cable is 860 ft. long and of 2-in. diameter. It is supported over the quarry



Cableway method of operation used at Weston & Brooker Co. quarry

from a fixed A-frame at the crusher platform and a traveling tower at the far end.

The traveling tower weighs about 300 tons and is mounted on railway trucks which travel upon two separate standard gauge railway tracks. A 90-h.p. electric-motor driven double-drum friction hoist is used to handle the skips on the main cable.

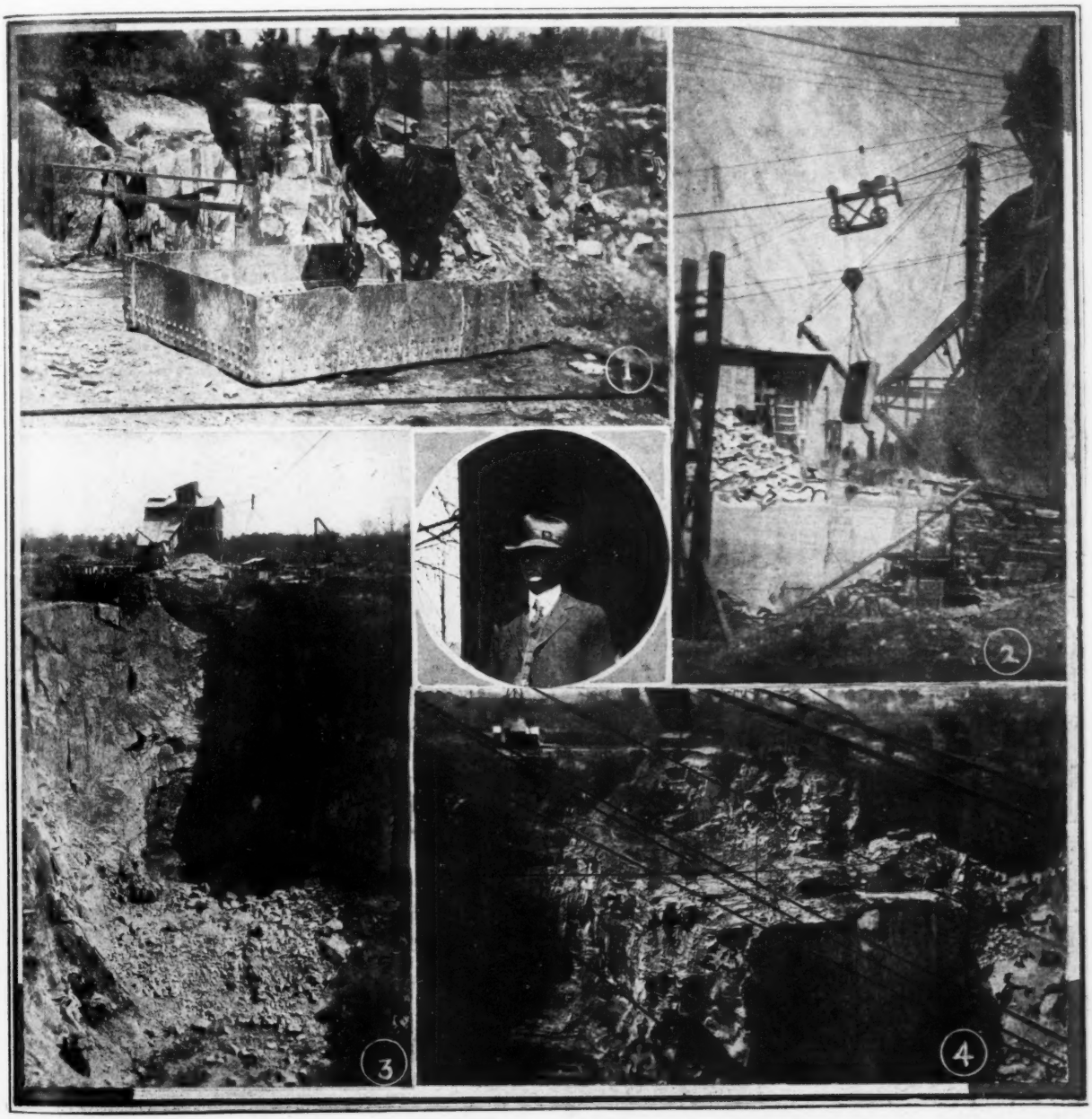
The cableway carriage consists of a sheet-stel carriage reinforced with angles, suspended from the main cable by means of six sheaves. The carriage and the special block at the skip are operated by four hauling lines in such a way that the skip may be raised and lowered at the same time it is moved along the cableway. It is also arranged to dump at the crusher end of the cableway through the towerman's control.

To spot a skip in the quarry for the loaders, it is run out onto the carriage, suspended by chains from the four corners and lowered wherever desired by the operator in the moveable tower. This tower carries the hoisting engine and it travels near the rim of the quarry face where the loaders are working, filling the skips.

Similarly the skips are picked up on signal from the men in the quarry and transported the 850 ft. to the crusher platform, where a colored-light signal warns the crusher tender that the loaded skip is ready to be discharged. The skip is then tipped so as to dump into the crusher by the hoist man.

Owing to the increasing depth of the quarry and the subsequent slowing up of the cableway operation, a second cut has been opened in the quarry and a second cableway installed. This second cableway is not so long as the first and does not have some of the improved features, such as the self-dumping skip, that the first cableway has. The capacity of the plant is about 1000 tons per day.

The president and treasurer of the Weston & Brooker Co. is T. I. Weston, B. O. Brooker is vice-president and assistant treasurer and W. S. Weston is secretary and general manager.



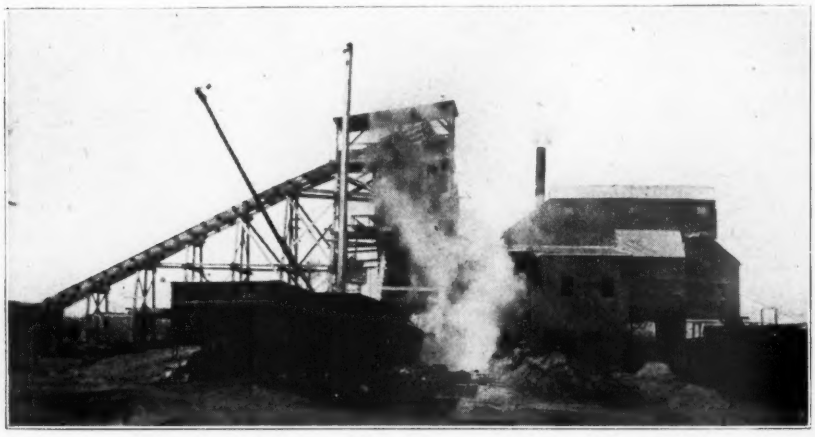
Various views of the quarry operation. Center insert, W. S. Weston

Hints and Helps for Superintendents

Quarryman Protects Users of Fluxing Stone

IF THE MAIN CRUSHER which is mounted in the quarry were to be disabled, the Foster & Creighton Co. plant at Rockwood, Ala., would not be entirely incapacitated. For just such an emergency as this the company has installed a derrick and has some skips on hand.

In event of an accident to the big crusher or the incline, the plant could put out a limited amount of stone by loading the skips in the quarry and then swinging the stone to a chute which would send the stone to the secondary crushers. This precaution is necessary because of the big fluxing-stone business that the company does and because the stone must be furnished without fail every day.



Fluxstone loading provided in case of shutdown of main breaker

Storage Facilities

WITH THE FLUCTUATION in car supply that is likely to stay with us for another season or two at least, it is being pretty generally recognized that no kind of a quarry or gravel plant operation can really succeed without making some provision for storage and for continuing operation in spite of transportation handicaps. The editor will be glad to receive articles and suggestions from plant operators on both methods and costs of storage.

It may be said that it is expensive to maintain a stock pile, but whatever the cost may be, there is one item a stock pile will offset, and that is the cost of running a plant at half capacity or less, which is bound to occur where a stock pile does not exist.

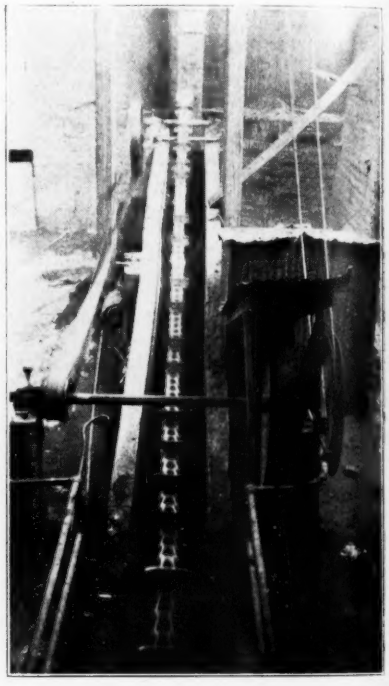
In other words, stock put into pile while business is slack has nothing to lose but the cost of reclamation.

Cement Clinker Coolers

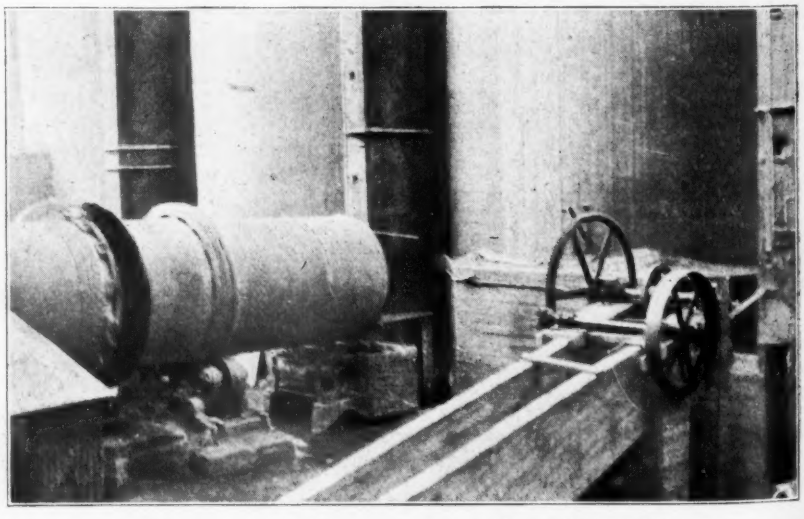
THE TWO VIEWS HEREWITH show a type of cement clinker cooler developed at the El Paso (Tex.) plant of the Southwestern Portland Cement Co. The cooler consists of a concrete trough and a drag conveyor. The clinker first receives a light sprinkling with water as it is fed into the lower end of the trough.

The trough is set on concrete posts at an inclination of 10 or 12 degrees from the horizontal and discharges into the boot of an elevator, which carries the clinker to concrete storage bins. The conveyor trough is about the same length as a rotary cooler.

The device is said to give as good satisfaction as a rotary cooler and at less expenditure of power. It was devised by O. J. Binford, superintendent of the plant.



Drag-conveyor clinker cooler



Rotary cooler and drag-conveyor working side by side

Dust Collecting to a Fine Art

THE VICTORVILLE PLANT of the Southwestern Portland Cement Co. (Victorville, Calif.), has been widely described as one of the model Portland cement plants of the world. Herewith are some new interior views of the plant taken by the editor on a recent visit.

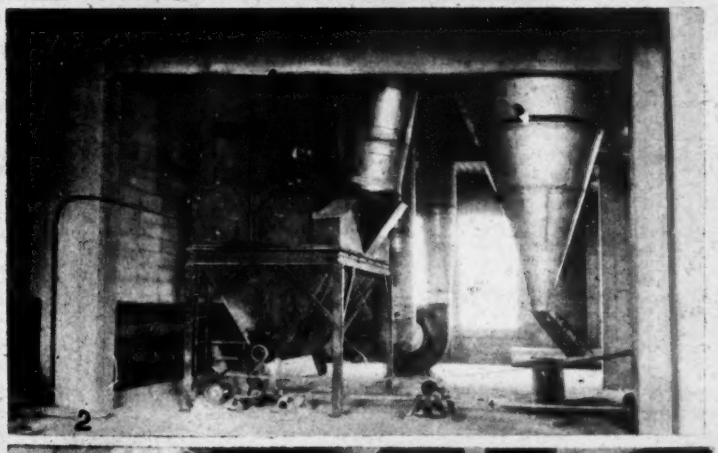
This plant has certainly reduced the dust-preventing and dust-collecting problem to a fine art. The process begins at the initial roll crusher, where the limestone and clay are dumped from the cars into the crusher hopper. The crusher tender sprinkles the material with a garden hose attachment.

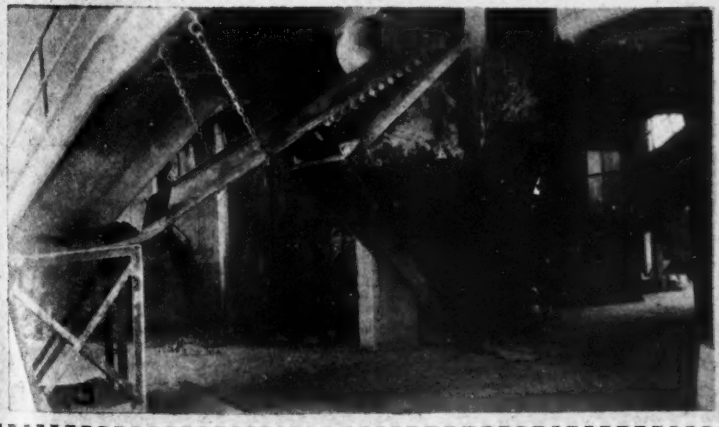
The stone then goes through a "Jumbo" Williams mill and surrounding this mill on the lower floor of the crusher house is about the only dust found in the entire plant.

The tube mill grinding the clinker is equipped with a suction pipe at the discharge end. This pipe (there is now another for the new tube mill) leads to a cyclone dust collector and bin in the room overhead. The wet process of cement manufacture is used so that there is no dust in connection with the raw-material grinding.

Under the bag-packing machines is the hopper and suction inlets shown in two of the accompanying views. These keep the packing room practically free from dust and recover and return to the packing bins a considerable amount of cement that would otherwise be largely wasted.

Carl Leonardt, of Los Angeles, is president of the Southwestern company, and P. C. Taylor is superintendent of the Victorville plant.





1. Sprinkling clay and limestone as it comes from quarry

2. Installing dust-collecting system in room over tube mills

3 and 4. Dust collectors under the bag-packing machines and bag chutes to cars

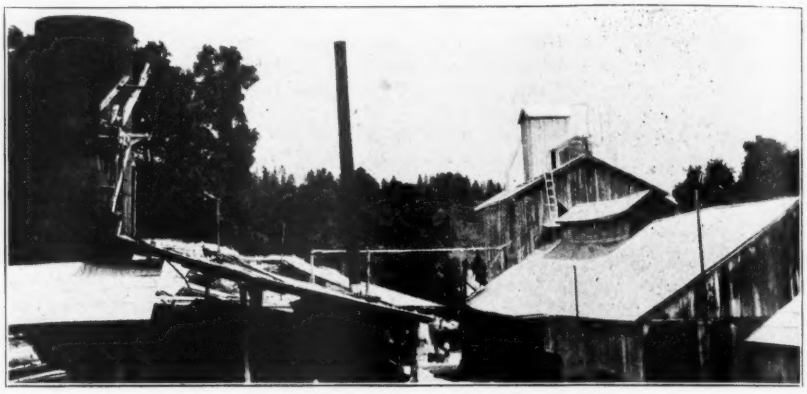
A California Hydrated Lime Plant

Peculiar Limestone Causes Abandonment of Shaft Kilns in Favor of Old-Fashioned Pot Kilns

THERE ARE VERY FEW LIME hydrating plants on the West Coast. Practically all the limestone that is burned there is a high calcium material, a very hot lime which is difficult to hydrate satisfactorily by mechanical methods.

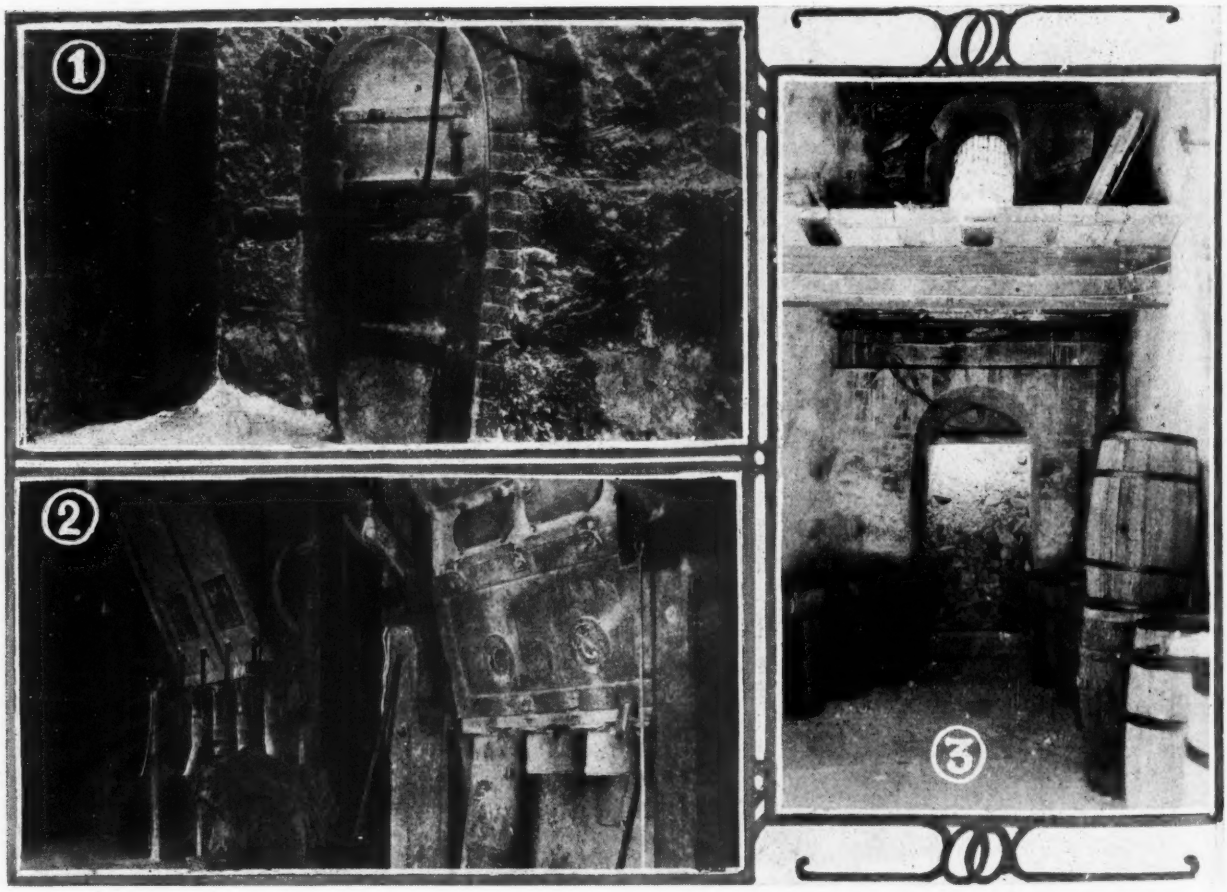
The lime plant illustrated herewith is that of the Holmes Lime & Cement Co., Felton, Calif. This is in the Santa Cruz limestone district, south of San Francisco.

The limestone here, as in most other sections of the far west is a coarsely crystalline stone, which burns readily to a white nearly pure high calcium lime. In many instances the stone occurs in pockets of nearly pure calcite.



Lime plant of the Holmes Lime & Cement Co.

Lime has been made from it for many years. A few years ago both the Holmes company and others in the vicinity installed modern steel shaft kilns, but in every instance these have been abandoned and a return made to the old fashioned type of pot kiln, constructed



(1) Oil burner of lime kiln; (2) Bagging machines for hydrate; (3) Kiln construction showing separate door below for drawing kiln

either of limestone masonry or concrete.

The kilns at the plant of the Holmes Lime & Cement Co., as shown in the views, are built of limestone masonry in a sidehill location. They are made both circular and rectangular in cross-section.

Oil-Fired

The operation of these kilns differs from the time-honored methods in use with nearly all kilns of this type, which is to charge them with alternate layers of fuel and stone. Here the kilns are first charged with a thick layer of wood and the burning process subsequently continued with special oil burners. Steam is used for vaporizing the fuel, which requires a boiler at the plant.

These kilns differ somewhat from those described in a previous article in being considerably deeper below the furnace doors. Apparently the object of this is to provide a separate door for taking out the lime. Thus it is possible to remove some of the lime while the kiln is still in operation.

This feature is probably of value in filling small orders of lime without shutting down a kiln, but as can be seen, most of the lime in the kiln would be difficult to reach through this door, and apparently the crumbly character of the lime requires that the kiln be cleaned out periodically, as with those described in a previous issue.

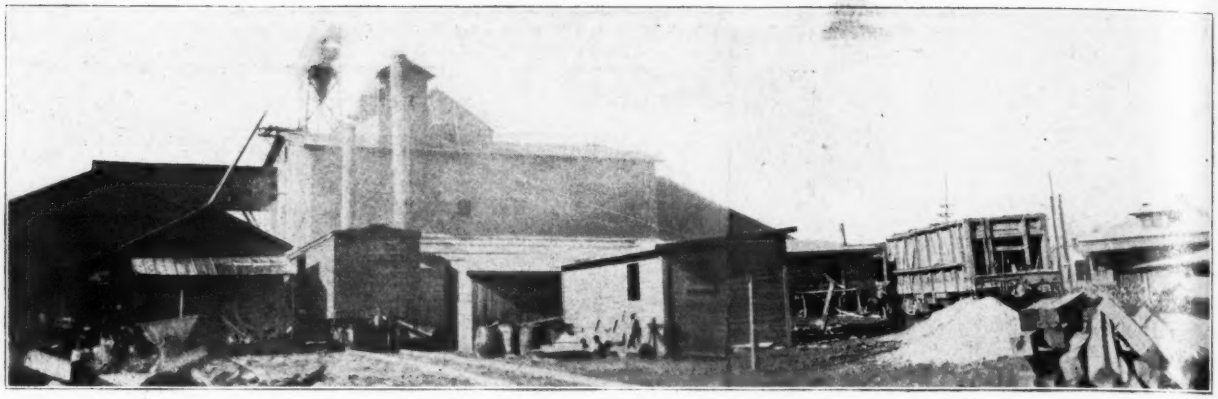
The hydrating plant is equipped with a Clyde batch hydrator and the finished hydrate is bolted through a cloth screen before being bagged for shipment.

The office of the Holmes Lime and Cement Co. is in San Francisco. John A. Buck, Jr., is president; W. E. Buck, vice-president, and Harry B. Gregg is secretary. The superintendent is George N. Ley, Felton, Calif.

Shortage of Lime

THERE is a shortage of all kinds of lime, and with it continuing high prices, and the reason is plain. No other material has so many uses outside of its primary field. The average dealer does not realize that since the beginning of the war there has been an enormous increase in the use of lime in various industries. It is used so extensively in the manufacture of soap, sugar, rubber, paper, leather, steel, textile goods, chemicals, etc., that some lime plants find it more to their advantage to cater to these industries than to the building supply trade. Furthermore, the demand for agricultural uses has increased wonderfully in the past few years, due to the work that has been done by the agricultural colleges and farmers' associations in various parts of the country. In recent years there has been very little increased output, due to high prices of machinery and the difficulty in securing the equipment. Until the output is increased the demand will exceed the supply, except possibly at short intervals.—"Tomkins Brothers."

Various views of the Holmes Lime & Cement Co. plant at Felton, Calif.



Grinding Raw Phosphate Rock for Direct Application to the Soil

Method of Pulverizing Raw Phosphate Rock at the Ruhm Phosphate Mining Company Plant

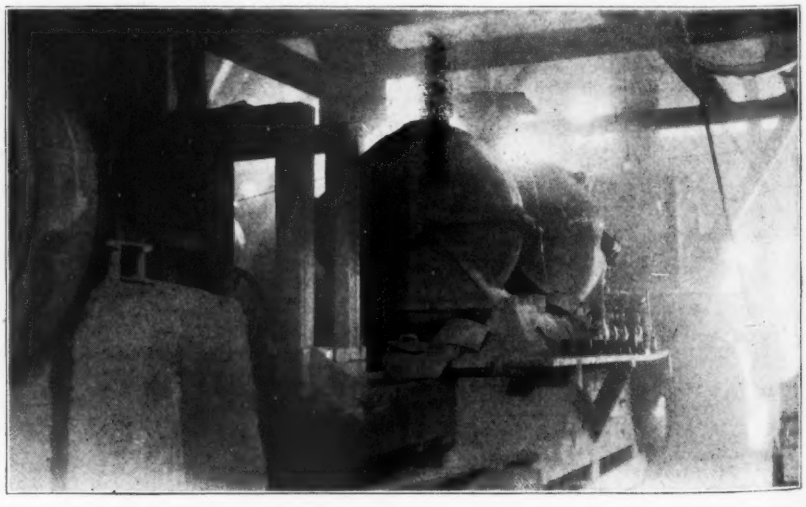
ARTICLES have appeared in previous issues describing the hydraulic method of mining and washing phosphate as it is done at the Ruhm Phosphate Mining Co., Mt. Pleasant, Tenn. At phosphate mines owned by most of the other companies the material is only washed and made ready for shipment, but in the case of the Ruhm Phosphate Mining Co. besides selling lump rock to the fertilizer companies, a large part is also pulverized for direct application to the soil.

John Ruhm, Jr., is one of the pioneers of the raw ground phosphate industry. Being an Illinois University man, he ground the first ton of phosphate used by the late Dr. Cyril G. Hopkins, who did so much to establish the use of raw ground rock as a fertilizer in Illinois. As a result this company is one of the oldest and most experienced ground rock phosphate producers in the middle Tennessee district.

The washed wet phosphate is delivered to the dust plant from the phosphate mines in hopper bottom railroad cars of the type extensively used for hauling iron ore.

The wet phosphate is fed into the hot end of the dryer. This is contrary to practice in other industries but it is found to be more efficient in the case of the phosphate. Where dryers have been fed from the cool end it is found that the shell is more quickly worn out and the material is not dried so effectively, and that more coal is required. The flame and heat in these dryers are put through the cylinder by an air blast passing through the furnace, from centrifugal fans. In the other type of dryers there is only the stack draft.

L. A. Orth, mechanical engineer, in charge of the operation of the dust plant, is working on an oil-burning dryer. As

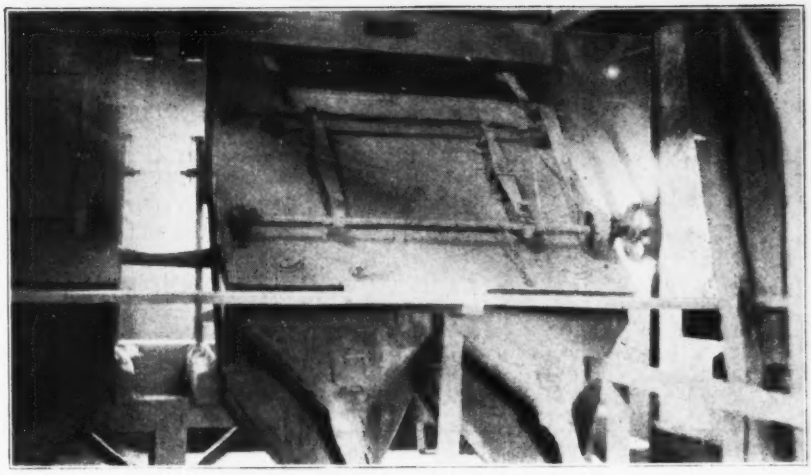


Interior views at Ruhm Phosphate Mining Co. plant

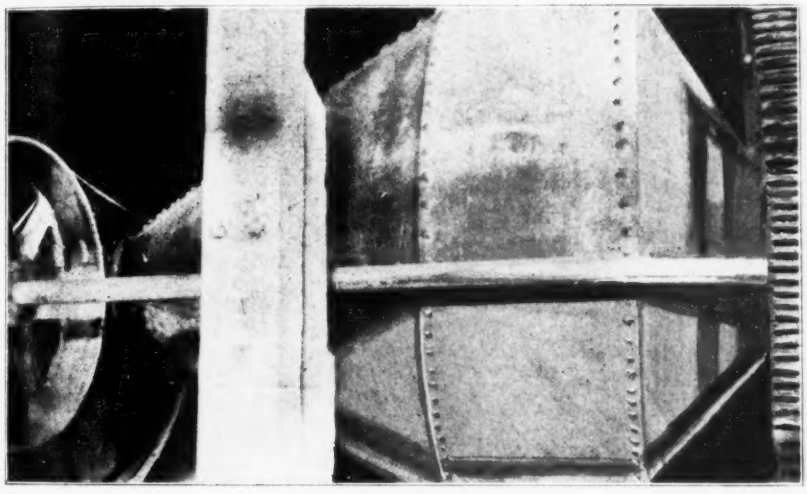
yet the dryer has not been operated sufficiently to definitely state the exact saving per ton of material dried, but it is known that this dryer may be fed about twice as fast as the coal-fired dryer. It differs but little from the coal burner in construction except that no air blast is used with it. The combustion chamber is somewhat smaller and the face is of fire brick. A Hammel nozzle is used to feed the oil and it is steam atomized, using a pressure of about 100 lbs.

Some of the difficulties encountered in the use of this dryer are in getting a fire started and the danger of flare back while the combustion chamber is cold. These, however, are small obstacles in comparison with the saving gained by its use.

The dried phosphate, which is ½-in. down material, is fed to a set of pulverizers



View showing screen



Mill used for pulverizing

where the finished product is made 90 to 100 per cent through 100-mesh. The pulverizing equipment consists of one Raymond system, one Sturtevant mill and one Hardinge mill.

The finished product is elevated from the machines and loaded into box cars or put into a large dust bin. In the case of the Raymond system, no elevator is needed to send the material to the cars and dust bins, for it flows direct from the collector on top of the mill building.

Only the pebble and sand material is pulverized giving a 20-hour output of about 200 tons.

Talc Mining in South Africa

Trade Commissioner R. A. Lundquist

THE MINING OF TALC in South Africa appears to be a development of the war period, as little appears to have been done in this field prior to 1913. Even then it appears that the early mining was for gold with talc as a by-product. The production for the past few years is as follows: 1913, 1 ton; 1915, 44 tons; 1916, 132 tons; 1917, 785 tons; 1918, 670 tons; and 1919, 757 tons. In addition to the above raw talc production the mines themselves have turned out a considerable amount of manufactured talc goods, totaling 412 tons in 1917.

Talc Mining Districts

The more important districts in which talc is found are the Barberton district, the Krugersdorf district of the Transvaal, in Zululand, and in Southern Rhodesia. The more important of the above is the Barberton district, though it is said that some very fine foliated talc is found in Southern Rhodesia. The area over which talc is known in the Barberton district is about 10 miles long and averages about a mile in width, and the deposit occurs in the form of nearly vertical bands up to 15 feet in thickness. It is said that the talc reserves in the Barberton district are enormous and if properly developed should yield a large tonnage available for export.

At present there are only about three producing talc mines in the Union. These are the Verdite mines, Jamestown, Barberton, Transvaal; the Scotia talc mines, Joe's Luck, Barberton, Transvaal; and the mines of B. R. Berrett, Greytown, Natal. The first two mines are the principal producers, and operate in the district between Jamestown and the Sheba Valley.

The Verdite mine and the Scotia talc mines each have a plant capable of dealing with 200 tons per month, though it is understood that recently the latter mine has developed its plant capacity to a point where it can turn out as much as 1,000 tons per month.

The talc is locally prepared along the lines of the French system, using a disintegrator of the "cyclone" type, with a fan separator.

The local demand for talc is not great, and both the Verdite mine and the Scotia talc mines have large surplus outputs available for export. For crushed massive talc the present quotation is £6 5s. per ton of 2,000 pounds, f. o. b. Delagoa Bay, for orders of not less than 200 tons. For uncrushed blue massive bulk talc the price quoted is £3 5s. per ton, f. o. b. Delagoa Bay, for orders of not less than 200 tons.

Anaconda Copper Mining Co., to Start Making Fertilizer Soon

THE Anaconda Copper Mining Co., the Bureau of Mines is informed, expects to begin quantitative production of a super-phosphate fertilizer in the near future. The company intends to enter actively into competition for a fertilizer market in the middle west. By manufacturing a fertilizer containing 48 per cent of the available phosphoric acid, the company's engineers are of the opinion that the high transportation charge can be absorbed and still be able to compete with the eastern-made fertilizers.

Practical Chemistry for Lime and Cement Manufacturers.

XIV—Fuels Used for Lime and Cement Burning and Their Relative Values

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THE CHIEF FUELS of interest to the manufacturer are wood, coal, oil, natural gas and producer gas.

Wood is composed chiefly of carbon, hydrogen and oxygen in about the proportions of:

Carbon	50%
Hydrogen	6%
Oxygen	43½%
Ash	½%

Wood has a heating value of about 8500 B.t.u. per pound or about 60 per cent that of good coal.

The value of wood for burning lime lies in the fact that it is low in sulphur, burns with a low flame temperature and the gases resulting from its combustion contain much steam. The latter two properties tend to make the temperature of burning low, hence the lime is free from fused material which slakes slowly and causes pitting.

Coal is found in two distinct varieties, anthracite and bituminous. Anthracite is relatively rich in carbon and low in hydrogen and consequently high in fixed carbon and low in volatile matter or hydro-carbons. Bituminous coals are the opposite. The following represent about the composition of the two classes of fuel.

The moisture represents the water in the coal and may practically all of it be driven off by drying such as is done in the cement industry before the coal is pulverized. The volatile matter represents the gaseous matter in the coal—compounds of hydrogen and carbon. These may be driven off by heating the coal to a red heat. In the manufacture of illuminating gas, by the older process, coal high in volatile matter is heated in clay retorts when the volatile matter, consisting principally of tar and gases such as methane, ethylene, etc., are driven off. Many chemicals such as benzol, toluol, etc., are also found in the tar. The fixed carbon is the carbon which remains when all the volatile matter is driven off from the coal. Coke is a mixture of fixed carbon and ash.

The ash is the mineral matter in the coal. Pure coal itself contains some ash but in car-load shipments of coal this mineral matter is greatly increased by slate from the roof and floor of the mine and also from between the coal layers, which is allowed to mix with the coal by careless mining. The ultimate composition is the same as elementary composition.

Steam coal should be low in volatile matter, while coal to be used in burning lime and for heating rotary kilns should be high in volatile matter. Ash, as every one knows, is undesirable as it has no heating value and not only detracts from the value of the coal but also melts and forms clinkers which cover over the grate openings and keep the air from getting at the coal to burn it. The ash also carries off some of the carbon which remains unburned and hence its heating value is lost.

PROXIMATE COMPOSITION

	Bituminous	Anthracite
Moisture	0.5- 6	2- 5
Volatile Matter	16 -40	3- 7
Fixed Carbon	40 -75	70-88
Ash	5 -20	5-15
B.t.u. per lb.	11,500-15,000	12,000-14,000

ULTIMATE COMPOSITION

	Bituminous	Anthracite
Carbon	60 -80	72 -85
Hydrogen	4½- 5¼	3 - 3½
Nitrogen	1 - 1½	½- 1
Oxygen	3 -12	3 - 7
Sulphur	½- 6	½- 1

Coke, as I have said, is coal from which the hydro-carbons have been driven off. Coal ash consists largely of silica, iron oxide and alumina and its composition resembles that of shale, slate and clay.

Natural gas is a mixture of marsh gas and hydrogen, together with small volumes of other hydro-carbon gases, oxygen and nitrogen. Marsh gas is the chief constituent. It is known technically as methane, and has the formula CH_4. Some natural gas, notably that from the Pittsburgh field, contains considerable hydrogen. A cubic foot of natural gas will give about 1000 B.t.u.

Producer gas is made by passing a mixture of steam and air through a deep bed of red hot coal. Or in other words, through a bed of carbon heated to the temperature at which it combines with oxygen and steam. Two reactions take place. The air on first coming in contact with the hot coal unites with the latter to form carbon dioxide

$$C + 2O = CO_2$$

The carbon dioxide on proceeding further up through the fuel bed is decomposed into carbon monoxide

$$CO_2 + C = 2CO$$

The steam is broken up by the hot carbon into hydrogen and carbon monoxide

$$H_2O + C = H_2 + CO$$

The nitrogen entering the producer along with the air does not combine with anything and simply passes out of the producer along with the other gases. Some carbon dioxide is not decomposed and some carbon monoxide is burned to carbon dioxide in the upper part of the producer so that some carbon dioxide also is usually present. Bituminous coal is generally used in making producer gas and when this is placed in the producer its hydro-carbons are distilled before it reaches red heat, and coke is formed, the latter furnishing the carbon for the gas. The coke is kept at the combining temperature by the heat formed when the carbon is converted to carbon dioxide.

Producer gas is composed, therefore, chiefly of carbon monoxide, hydrogen and hydro-carbon gases, which are the combustible gases, and of nitrogen, carbon dioxide and some little oxygen which are inert and of no value. Below is an example of a good grade of producer gas.

Carbon monoxide	22.0%
Hydrogen	10.5%
Hydrocarbon gases	0.6%
Methane	2.6%
Carbon dioxide	5.7%
Nitrogen	58.2%
Oxygen	0.4%
B.t.u. per cu. ft.	150

Heat Units

In order better to study and understand the use of fuels, an elementary knowledge of thermo-chemistry or heat-chemistry is needed. We can measure heat just as we can electricity by the effect that it produces. It is known that a given amount of heat will raise the temperature of a known weight of water by a definite number of degrees of temperature. Based on this law of physics we have certain units by means of which we can measure the quantity of heat.

Most of us know that there are two thermometer scales, one the Fahrenheit (F), or English standard, and the other the Celcius or Centigrade (C), or French. In both scales there are two fixed points—the temperature at which water freezes and that at which it boils. The conditions such as pressure being the same the temperatures at which water makes these two changes are fixed. In the English scale it freezes at 32° and boils at

212°. It will be seen that there are 180° between the freezing and boiling points of water on this scale. Similarly, water freezes at 0°, and boils at 100° on the Centigrade scale, hence there are just 100° between the boiling and freezing points on these two scales. It is evident from this that 100° Centigrade are equivalent to 180° Fahrenheit, or 1° Centigrade to 9/5 or 1.8° Fahrenheit, etc.

The French have also a system of weights and measures different from the customary or English standard. In this the meter is the unit of length instead of the yard, and the kilogram the unit of weight instead of the pound. One kilogram is equivalent to 2.205 lbs. avoirdupois.

The *British thermal unit,* which is generally abbreviated to B.t.u., is the quantity of heat which is required to raise the temperature of 1 lb. of pure water 1° F., at or near 39.1° F., the temperature of its maximum density.

The *Calorie,* which is sometimes abbreviated to Cal., is the quantity of heat necessary to raise the temperature of 1 kilogram of water from 4° C. to 5° C.

Since a kilogram is equivalent to 2.205 lbs., and 1° C. to 9/5° F., the Calorie is equivalent to 9/5 of 2.205 or 3.969 B.t.u., and the B.t.u. to 0.252 Cal. In expressing the heating value of a solid or liquid fuel, however, this is done in *B.t.u. per pound* or else in *Cal. per kilogram.* The B.t.u. produced by the oxidation or reaction of 1 lb. of a substance is equivalent to 9/5 of the number of Calories which would be produced by 1 kilogram of the substance. Hence, to reduce Calories per kilogram to B.t.u. per pound multiply by 9/5 (or by 1.8); while to reduce B.t.u. per pound to Calories per kilogram multiply by 5/9 (or by 0.555).

The "British thermal unit per pound" is the unit usually employed by engineers for expressing the heating value of fuels, while the "Calories per kilogram" is used in most scientific calculations. In expressing the heating value of gases, the terms British thermal units per cubic foot, and also Calories per cubic meter, are used The former is derived by multiplying the number of B.t.u. obtained from 1 lb. of the gas by its weight per cubic foot, and the latter is the product of the Cal. per kilo by the weight per cubic meter.

(To be continued)

Chemists Discuss Potash Problems

AT THE RECENT meetings of the American Chemical Society at Chicago several important reports were presented by the division of fertilizer chemistry. Potash problems were discussed by two speakers. S. W. Parr, of the University of Illinois, described several potash shales of Illinois which were recommended as suitable for cement manufacture with potash by-product recovery. These shales having more than 5 per cent of K_2O would yield, if properly handled, over 5 lbs. of potash per bbl. of cement, equivalent to 70 or 80 cents per bbl. of by-product income.

H. A. Huston, who has investigated the potash situation in Germany, personally gave a full report on the situation. He says a complicated organization has resulted from the socialization of the industry. Labor is available in sufficient quantity but is very high. Transportation is difficult and very expensive. The fuel supply is short and costs are very high. This fuel situation has been particularly aggravated by the interruption of Silesian coal supplies by the fighting between the Poles and Reds. Incidentally the shortage of fuel has also resulted in the shortage of ammonium sulphate for fertilizer use.

The claim that discrimination had been made against the United States purchasers of potash is believed contrary to the fact by Mr. Huston. He states that contrary to general belief there were no large stocks of potash available either at the end of 1918 or at any time since then. There were certain portions of production reserved for the United States purchasers through the arrangement of the inter-allied agents who controlled these matters. However, these agents were notified by someone that the United States did not need these supplies. They were, therefore, quickly disposed of elsewhere. As a consequence when purchasers from this country attempted to secure potash there was none available except at excessive prices. This has naturally led to the conclusion that the American purchaser was being discriminated against. Mr. Huston states, however, that the American purchaser has at all times been able to purchase as favorably as others who are in the market at the same time.

Extension of Lime Association Organization

FURTHER EXTENSIONS of the organization of the National Lime Association for educational publicity work have recently been made. This is in the direction of intensifying the local or district work similar to that which has been in progress for several years in the Eastern Bureau of the Association, which embraces roughly the territory of New England, eastern New York, and the coast states as far south as Maryland.

The latest extension of the organization consists of the establishment of a central bureau in the Mississippi Valley, comprising Districts 7 and 12 of the Association which include the states of Indiana, Illinois, Missouri, Nebraska, Colorado, Kansas, Oklahoma, Arkansas, and Louisiana. The officers of this central bureau are Colonel C. W. S. Cobb, of the Glencoe Lime & Cement Co. of St. Louis, chairman, and T. P. Black, of the Black White Lime Co. of Quincy, Illinois, secretary. They will employ a permanent field man, who is a trained engineer along construction lines and qualified to deal with the chemical and agricultural uses of lime, to traverse the territory and assist in the best use of lime products in the three aspects in which it is employed, namely, in construction, in various chemical industries, and in agriculture.

A similar organization is developing in District 5 of the Association comprising the state of Ohio. Plans are being worked out through the central office of the association for making field men representing its several technical departments available in these regional bureaus.

Few materials have a wider range of use than lime, as is illustrated by the departments of the association. More than 115 industries listed in the United States Census use this material in some of their processes. While it often does not enter into these in relatively large amounts, it is none the less necessary. To be in touch with its proper chemical, physical, and biological uses in all these fields is to span a large section of scientific knowledge and practical industry. To make these processes and uses better understood and better applied by the public is the purpose of the educational work of the National Lime Association.

State Commissions Organize for Rate Hearings

A SPECIAL committee, representing some of the state railroad commissions has been organized to "safeguard" the interests of the state commissions in the hearings to be held on the application made by railroads asking the Interstate Commerce Commission to remove alleged discrimination against interstate commerce because of refusal of various state commissions to authorize increases in intrastate freight and passenger charges to the same extent that interstate rates have been increased.

The committee is composed of: Fred W. Putnam, member of the Minnesota Commission; H. G. Taylor, member of the Nebraska Commission; R. Hudson Burr, member of the Florida Commission; Joseph A. Kellogg, member of the New York Commission, Second District, and Joshua Greenwood, member of the Utah Commission.

Oil Shales and Their Economic Importance*

Development of Deposits Will Require Time, Study and Much Money

By Martin J. Gavin
Refinery Engineer, Bureau of Mines

THE TWENTIETH CENTURY has often been spoken of as the age of petroleum, and from many viewpoints it can be justly considered so. Certainly the petroleum industry is one of enormous importance to this country, industrially, financially, and economically. The United States, however, at present producing over 60 per cent of the world's total output of petroleum, is not producing petroleum at a sufficient rate to provide for its own domestic consumption. For several years this country has been importing increasing quantities of crude and partly refined oils from Mexico, and has been drawing heavily on domestic stocks of petroleum. Production in the United States is increasing, but it is not increasing at the same average rate as domestic consumption, nor is it probable that in the future domestic production will increase sufficiently to satisfy the demands of domestic consumption, but on the contrary, in the opinion of those best qualified to know, the peak in the curve of domestic production of crude petroleum will be reached in a comparatively few years, whereas the consumption of petroleum and its products will increase at a continually growing rate. This country, then, must turn, and as the increasing imports from Mexico indicate, is turning to other sources than the crude petroleum produced in this country to make up the deficit between domestic production and domestic consumption of petroleum and its products.

The chief products of petroleum are, motor fuels, kerosene, fuel oils, and lubricating oils. Of these, the increasing demand for motor fuels or gasoline is perhaps the greatest, and that of fuel oils probably next greatest. The ever-growing use of the internal combustion motor, especially in automobiles and trucks accounts for the first, and the increasing use of fuel oil, chiefly for steam-raising purposes, accounts largely for the second. Lubricating oils are, of course, of prime importance, as machinery must be lubricated if it is to operate.

To help make up the deficit in our supply of petroleum we can expect to draw on the enormous potential petroleum supplies of Mexico at an increasing rate, and by the use of new and improved processes of manufacture a greater percentage of the petroleum products for which there is the greatest demand will undoubtedly be obtained from petroleum. The more efficient utilization of these products, as for example, through the development and use of the Diesel engine and the gradual change in the design of our present internal-combustion motors, enabling them to use lower grade fuels, will perhaps tend to relieve the growing shortage. Hydroelectric power or electricity otherwise produced can be expected to take the place, to a certain extent at least, of fuel-oil installations on land. However, all these expedients have their practical limitations, and it is to be expected, therefore, that in the comparatively near future new sources of products similar to those now being derived from oil-well petroleum will have to be developed. As a matter of fact, some are already being developed.

There are possibilities of importance in the development of the production and use of benzol as a motor fuel and other coal-tar products as Diesel engine fuels and as substitutes for other petroleum products. There are also important possibilities in the commercial production of alcohol as a motor fuel. In fact, blends of alcohol, benzol, and petroleum distillates are being marketed in the East at the present time as motor fuels and are giving satisfaction in use. Taking all these considerations into account, however, it is the opinion of many that the oil shales of Utah, Colorado, Wyoming and Nevada, and possibly other states, are extremely important as new sources of products similar to those now obtained from oil-well petroleum. These states contain enormous deposits of oil shales which by proper treatment yield gas, oil, and also, if desired, ammonia, of value as a fertilizer. The oil in many respects is similar to oil-well petroleum and yields products similar to those of petroleum.

Oil shales have been worked in Scotland and France for upwards of sixty years. In the former country the industry has been a successful one from a financial standpoint, especially of late years, although it is passing through a difficult period at present. The industry in France has not been nearly so successful as that in Scotland. The success of the Scotch shale industry has been partly brought about by the development of cheap processes for treating the shales and the oils produced from them, but mostly by local conditions, such as competition only with high-priced petroleum products, low labor costs, and the fact that the industry grew up in a densely populated region where a ready market for oil and ammonium products was available. A recent reorganization of the Scotch shale companies, combining them into one organization, is hoped to better the present condition of the industry in Scotland.

Oil shale contains little or no oil as such, but it contains substances which, when the shale is subjected to destructive distillation, yield gas, crude oil and nitrogen-containing compounds, notably ammonia, as well as other products in small and probably of unimportant value for the most part. Oil shale, as a rule, must be mined much as coal is mined, crushed, and heated to a relatively high temperature in closed retorts which may operate continuously or intermittently. These steps are necessary to produce the gas, crude oil and ammonia, the latter of which is in solution in the water obtained along with the oil.

The ammonia water is then distilled and the released ammonia passed into sulphuric acid, producing ammonium sulphate. The crude oil must be refined, much as petroleum is refined, to produce the various commercial products. The refining of shale oil is more complex and in all probability more costly than the equivalent refining of petroleum. However, undoubtedly the shale oils can be refined and can be made to yield many products similar to those produced when petroleum is refined. The oils produced from the oil shales of this country will yield gasoline, burning oils and paraffin wax, all of which when properly treated will undoubtedly be satisfactory commercial products. Whether the more viscous grades of lubricating oils, such as lubricants for internal-combustion motors, can be produced from shale oils is doubtful, but it may be possible to do so. Little is known in this country as to the refining of shale oils at the present time, and this statement can be applied generally to the

*Presented by permission of the Director, U. S. Bureau of Mines, before the 13th Convention of the Utah Academy of Science, April 3, 1920.

possibilities and technique of oil-shale operations in the United States.

The development of an oil-shale industry to one of considerable importance in this country, will require the expenditures of many millions of dollars and take a period of many years. Such development will require much research and technical study, and will require the services of trained executives and experienced technicians. Nevertheless, when economic conditions become favorable it is reasonable to believe that our oil shales will be of great value as a source of oils similar to those now derived from petroleum. An idea of what large-scale development of the oil-shale industry involves may be gained from the consideration that to produce one barrel of crude oil from shale, on the average at least one ton of a tough rock must be mined, crushed, heated to a relatively high temperature, and finally the residue, amounting to about 75 per cent of the original weight of the raw shale, must be disposed of as valueless. The United States now produces over one million barrels of crude petroleum per day.

Our immense oil-shale deposits practically assure us that come what may this country will still have its own sources of petroleum products. We should never have to be wholly dependent on foreign countries in this respect. From another standpoint the shales are also of great economic importance. The oil shales, especially of the Rocky Mountain country, occur in sparsely settled regions. Their development on a large scale means the bringing into these regions of a great number of miners and other laborers, often with their families, who will earn their living in the shale fields and spend their money in the same locality. Millions of dollars must be spent in erecting plants, developing mines, and the like, much of which will be spent in the states where the oil shales occur. The shale-oil refineries will require sulphuric acid and other chemicals and supplies, which logically will be produced as near to the shale fields as possible, thus bringing in more capital and labor. Transportation facilities will be extended to meet the requirements of the shale operators, thus benefiting the regions now inadequately supplied in this regard. Prices of petroleum products in the regions contiguous to the shale operations can be expected to be relatively lower than they would be if similar petroleum products had to be shipped in.

It should again be emphasized, however, that development of an oil-shale industry to a scale sufficient to be of so much economic importance, will require much study, time and money. The oil-shale industry is no business for the man of little experience and small capital. It may be compared with the development of the low-grade copper ores of the West, in that it is a large, low-grade, chemical manufacturing enterprise, requiring capital, time and trained men. The investor in oil-shale operations should know that he will probably have to wait for a long time for a return on his investment and that returns in all probability will be conservative. In spite of this, the day of the oil-shale industry is coming. When, it is difficult to predict, but some day it will undoubtedly be one of great importance. —U. S. Bureau of Mines, Reports of Investigations.

Shale Mixed With Ordinary Coal Makes an Ideal Smokeless Fuel

Use of Shale As a Fuel Mixed with Coal Opens New Field for This Material

ANOTHER USE FOR OIL SHALE has been discovered by P. O. Perkins of Salt Lake City. Mr. Perkins has found that by burning ordinary oil shale with coal that less of the black smoke, which comes from ordinary coal fires, is in evidence. A test was made in Salt Lake recently at the Semloh hotel, according to the Salt Lake Tribune.

A mixture of soft coal and shale broken to approximately one-inch mesh, was spread upon the firebox of the Semloh hotel boiler. The coal was thrown into the firebox as under ordinary circumstances, and the shale, in quantity about one-fourth of the amount of the coal, was thrown on the top of the coal. In several moments the steam gauge began to rise steadily. When the party went out into the street no smoke could be seen issuing from the stack.

As soon as the charge of shale had been burnt out, Mr. Perkins had the furnace fired with coal without any shale. Immediately a black column of smoke rolled out of the stack. The virtues of the mixed fuel, consisting of shale and coal, is its simplicity of use, its economy, and its perfect combustion, according to Mr. Perkins, who has patented the process and spent considerable money in experiments and trying to interest capital in the plan.

"The simplicity of my plan for eliminating smoke is perhaps its chief drawback," said Mr. Perkins. "People are skeptical that so simple an operation can give so excellent results. This shale-coal fuel can be used in any furnace. As there is an inexhaustible supply of oil shale in Utah, and as the shale can be produced cheaper and marketed at a less cost than coal, not only will the use of mixed shale and coal solve the smoke problem here in Salt Lake City, but it will mean a more efficient fuel at a reduced cost. Some engineers have raised objection to using shale in the furnace on the ground that the mineral will clinker and clog the fire grates. I have found that the shale, crushed to the size we use it, burns to a light substance easily broken to powder and adding little ash and no clinkers."

Mr. Perkins explained his process as follows:

"By burning oil shale with coal in proportions of about one of shale to four of coal, a perfect combustion is secured. Coal, when used alone, lies on the fire some six to eight minutes before it begins to blaze, and during this period and for a time afterward it gives off heavy gas and carbon which, not having the flame to burn them, passes away in smoke.

"When oil shale is used with the coal in the proportion above stated, a very different action takes place. As soon as the shale is thrown in the firebox it blazes up with a steady, hot flame which burns the gas and carbon that is cast off by the coal, making a perfect combustion and positively no smoke.

"To eliminate smoke in an ordinary furnace using coal alone, it is necessary and so ordered by the city inspectors to open the door of the firebox from two to four inches. This causes cold air to rush over the fire and prevent the smoke showing. The reason for the smoke not showing is because the air thins it out. The gas and carbon are there just the same, and pass up the chimney unburned and invisible, and so many heat units are thereby lost. In my opinion, at least half the efficiency of the coal is lost while the door remains open.

"With the use of oil shale and coal the door of the firebox is closed tight, securing full efficiency of the fuel. Further attention is called to the greater efficiency of the oil shale-coal fuel, in the fact that the perfect combustion secured and eliminating the smoke leaves the heating surfaces of the boiler clean, allowing it to work at highest efficiency at all times, thereby making a big saving in fuel.

"After firing with coal alone the steam gauge drops back from 10 to 15 pounds. Firing with the oil shale fuel it does not drop back. It rises at once. This means much better results from the fuel."

Cleaning Phosphate With Air

The Peerless Phosphate Company, Columbia, Tennessee, Builds Plant Which May Revolutionize Rock Phosphate Industry

A METHOD of cleaning rock phosphate with air has been perfected by H. A. Webster, chemical engineer of the Peerless Phosphate Co., Columbia, Tenn., and S. B. Kanowitz, engineer of Raymond Bros. Impact Pulverizer Co., Chicago, Ill., which is likely to have a far-reaching effect on the entire rock phosphate industry. Hitherto phosphate rock has been quarried and mined for the crushed rock as the main and most desirable product and the pulverized rock or dust as a by-product.

The product of the quarry or mine has hitherto been washed with water and dried. The washing and subsequent settling of the material was depended upon to remove the fine clay and silt and leave the phosphate, which was then dried and crushed and ground. For the success of this method the major part of the material had to be in coarse fragments; from 10 to 15 per cent of the finest particles of phosphate were lost along with the silt.

With the process devised by these engineers, phosphate rock in its finest state of division may be treated successfully, and also one in which the fine stuff predominates. In his process the coarser fragments become the by-product, while the fine material formerly wasted becomes a main product. The raw material he handles is already 60 per cent through 100-mesh in fineness.

The elements of this newest process were described in ROCK PRODUCTS, April 10, pages 34 to 37, in the article on the principles of air separation. Mr. Webster explains that the dirt or impurity in the phosphate rock is a sandy clay, which when perfectly dry, separates into silica sand (silt) and a very fine aluminous material or clay, both of which being slightly lighter than phosphate dust are readily separated from it by air currents.

This use of air for the concentration of phosphate rock has made available many deposits which hitherto had been found impracticable to mine and prepare for the market in the usual manner by washing. There are many deposits found in Tennessee which are in such mechanical condition that washing is out of the question since the phosphatic particles are in such fine state of division that most of them would be washed away with the clay impurities and the recovery would be extremely low. On the other hand there are many deposits which, although in the proper condition to be washed, are too low in grade or too high in iron and alumina to be properly utilized in the manufacture of acid phosphate. Such deposits make ideal material for air cleaning and grinding for direct application on the soil. For example, there are many low grade deposits running in grade somewhere around 55 per cent B.P.L., which cannot be washed above a 70 per cent grade, which in normal times is too low in grade for manufacturing into acid phosphate since its iron and alumina contents might run as high as 8 to 10 per cent. Now for ground rock purposes a 65 per cent grade is about what is required by the farmers. Here by the method of air cleaning it is possible very cheaply to raise the grade from 55 to 65, with the following results: Out of five tons of 55 B.P.L. material fed to system there was obtained about 3.5 tons of 65 per cent grade and 1½ tons of about 31 per cent grade. This latter grade is usually sold to be utilized as a filler.

The time when these tests were run was abnormal as there was a great demand for Tennessee rock from all over the country as any grade found a ready market so that no time was given to perfect the apparatus and run the tests to actually see what the limitations of the air system were and how the high grade could be made from various deposits for rock.

Tennessee brown rock as mined consists principally of plate fragments, disintegrated plate rock or phosphatic sand along with impurities such as clays, pieces of flint and silica sand. It is the object of cleaning to remove the clay which is high in iron and alumina, thus leaving the concentrate much richer in phosphate or B.P.L. Where the rock contains a too high percentage of silica sand it is not possible under present conditions to eliminate it either with a washer or with the present air cleaning system.

Operating Methods

The mining methods of the Peerless Phosphate Co. do not differ from the general practice of this district of working the brown, disintegrated rock.

The material is excavated by a dragline excavator with a 1-cu. yd. dipper, and is loaded into 4-cu. yd. cars. These cars are made up into trains, sent to the cleaning plant, and emptied in a 400-ton capacity "green rock" storage.

The green rock is fed to a wide belt at the bottom of the hopper and sent to a dividing hopper where two parallel conveyor belts deliver it to two specially constructed dryers. This arrangement enables an exact feed to the dryers.

The function of the dryer is twofold; one is to remove the moisture from the rock and the other is to break up the clay balls and also to give a rubbing action to the material, thus removing considerable clay which adheres to the grains of phosphate. Quite a little of this clay, due to the draft in the dryer, will be carried out through the stock, thus helping to raise the grade.

The material which passes through the screens now, consisting of small pieces of phosphate, small clay balls, phosphatic sand and clay dust, is passed to Raymond automatic pulverizers for actual cleaning, i. e., for the separation of the phosphate particles from the clay.

From the dryers the phosphate is elevated to the third story of the mill where it is crushed and fed to a right-hand and a left-hand revolving cylindrical screen, each 20 ft. long and with ¼-in. meshes. Here a separation of lumps and phosphate sand is made—also the rolling of the material around in the screens causes any remaining fine silt to be knocked loose from the particles of rock. This silt floats in the air as dust and is removed by a suction at the discharge end of the screens.

The larger lumps of phosphate rock are now clean and ready for shipment to manufacturers of acid phosphate. (The lumps are of course rejected by the two screens.) The finer phosphate and any remaining impurities pass the meshes of the two screens and are sent to the rock-phosphate plant to be ground and shipped for direct application to the soil.

The pulverizer is a beater mill of the impact type equipped with the standard Raymond double-cone vacuum air separator which can be adjusted to separate material of various fineness from the aggregate and return the rest to the pulverizer for further treatment. After the material of the desired fineness has been separated, it passes into a fan and blows up into a cylcone collector which in turn discharges into bins or storage sheds.

The pulverizer is also equipped with an automatic throwout which automatically rejects material of too refractory a nature to be pulverized by the beaters.

The speed of the beaters is so adjusted that when the material is fed to it, the intensity of the blow is strong enough to break up any little clay ball to a dust, making it possible for the air to pick up this clay dust and deliver it to the cylcone collector. The phosphate particles, however, are too hard to be beaten up by the beaters small enough to be taken up by the air current. These particles soon accumulate and are discharged by the beaters through the throwout. This material is the finished product and is either shipped to acid phosphate plants or ground in a roller mill and sold to the farmer direct.

The automatic pulverizers are standard equipment and are the same machines as are used in the lime industry for pulverizing and separating hydrated lime. Here the beaters beat up the hydrate which is carried off by the air to the cylcone as finished product, the throwout rejects all hard material such as sand, grit, core and clinker which in this case is an impurity. We thus see that the results obtained in the phosphate cleaning are just the reverse; there the cylcone product is the impurity, while the throwout product becomes the commercial grade.

Following the material through the plant in more detail, take 200 tons and note how the grade is raised at various stages and what recovery is made. This is not a hypothetical example, but the data given below was obtained from an actual run. This material had the following analysis as it came from the mine: 53.5 B.P.L.; iron and alumina, 11.6; moisture, 13 per cent. After coming out of the dryer we obtained the following analysis: 54.5 B.P.L.; iron and alumina, 11 per cent; moisture, 3.5 per cent, and had left 175 pounds of dry material. The material now passed to screens which took out the plate rock over ¼ in. in size. This amounted to about 42 tons or about 24 per cent, analyzing 74.5 per cent B.P.L. and iron and alumina about 3.7 per cent, the undersize of the screen, amounting to 133 tons, analyzing 48.2 per cent B.P.L. and 13.31 and alumina now passes to the pulverizer for cleaning. The pulverizers were so adjusted so as to throw out a product grading to about 65 per cent B.P.L. Of the 133 tons fed to the pulverizers 66.5 tons came out of the throwout analyzing 65.1 per cent B.P.L. and 7.3 per cent iron and alumina. This material now passed to roller mills and was ground to be sold to the farmers or to fertilizer plants. The rest of the material, or 66.5 tons, having the following analysis, 31.3 per cent B.P.L. and 19.3 per cent iron and alumina, is blown up to the cylcone, from where it is discharged to be sold as a filler to the fertilizer trade.

Storage and Loading Facilities

The lump rock from the ends of the screens is emptied into a small electric trolley-driven dump car and disposed of either to box car or storage.

The plant has considerable storage space which is divided up as follows: The lump rock storage is 60x200 ft., the ground rock storage is 60x100x25 ft., and two 200-ton bins are provided at the tops of the elevators from the dryers so that the rock can cool before being sent to the rest of the plant.

Three 200-ton car-loading bins have been provided over the tracks so that when necessary a car may be filled from them in an hour. This aids the company to move cars quickly when the railroad finds it necessary. As a result the railroad company gives better service.

The plant operates day and night and has a 24-hour capacity of 400 tons. The entire plant is driven by electric motors —the connected load being 500 h. p.; only 375 h. p. is used. The power requirements are less than one horsepower per day per ton of material produced.

A laboratory is provided where all research work is done and where the operation is controlled. The material from every stage is analyzed twice per day.

The officers of the company are R. P. Meachan, president; J. A. Curtis, secretary; E. T. Schuller, treasurer and general manager; E. W. Steece, sales manager, and H. A. Webster is chemical engineer and designer of the plant and process.

Florida Phosphate Shipments Show Large Increase

REPORTS FROM FLORIDA on phosphate shipments just compiled for the month of August are interesting. Phosphate shipments by water from Tampa broke all monthly records during August, a total of 156,671 tons as compared with 143,318 tons during last May, which was the previous record month. With August records included more rock has been shipped by water during the first eight months of 1920 than during any similar period in the city's history, the total shipments to Sept. 1 being 894,096. During August 45 vessels sailed from Tampa with phosphate rock, seven from the Seaboard terminals. The cargoes of 16 of these vessels were consigned to foreign ports, the other 39 went coastwise. A total of 69,054 tons of phosphate was shipped to foreign countries and 87,617 tons to other ports in the United States. The Seaboard elevator handled 22,519 tons of rock and the A. C. L. 134,152. The A. C. L. elevators handled 85 per cent of the total shipments. All indications are that the year 1920 will see all records for phosphate shipments from Tampa broken. An average of 111,762 tons of phosphate has been shipped by water each month during 1920, against a monthly average of 103,769 tons in 1911, which previously had the yearly record. Unless shipments fall off during the remaining four months of the year 1920 the total shipments will probably be around 1,350,000 tons against 1,245,289 tons in 1911 the last banner year. During August 1919 only 4,996 tons of phosphate were shipped from Tampa, the trade being effected by after war conditions. The shipments of August 1920 are more than 3,000 per cent over the same month in 1910.

To Test Phosphate

THE Anaconda Mining Co., of Anaconda, Mont., is going to distribute a carload of phosphate among Missouri farmers. This phosphate tests from 45 to 48 per cent available phosphate, while the ordinary commercial product now used here, runs about 16 per cent. The carload will be distributed by the Anaconda firm among 40 farm bureaus of the state and is for testing purposes. If it proves satisfactory, the company will sell to Missouri farmers next season through the Missouri Farm Bureau federation and other farmer organizations of the state.

Big Limestone Storage

GROUND was broken August 16th for the first storage unit to be added to the Agricultural Limestone plant of the Michigan Limestone & Chemical Co. at Buffalo, N. Y. This unit, built of steel and concrete, will have a capacity for storing 18,000 tons of finished agricultural limestone or 600 carloads. In the attached bagging house will be installed eight Bates bagging machines, capable of turning out 60 carloads per day of sacked limestone.

With the increased track facilities, this storage will enable the company to load and ship upwards of 100 carloads of agricultural limestone daily.

Oil Shale Deposits in Southern Ohio

CONSIDERABLE interest in shale development has been aroused in Kentucky and Southern Ohio. It is stated that geologists have announced that at least 10,000 acres in the vicinity of Ironton, Ohio, overlie a rich shale deposit. In addition to ample timber and water supply, there is an outcropping of iron ore in the vicinity, also a twelve-foot vein of fine clay and coal. There is also a strata of ganister, which, it is claimed, is a stone possessing the greatest heat resisting quality known. At the edge of the land 26 gas wells are flowing and geologists stated that the district contains every mineral, except the precious metals.

Sand and Gravel Producers Meetings

National Association of Sand and Gravel Producers Holding Series of Conferences in the South

THE National Association of Sand & Gravel Producers was responsible for a series of meetings in some of the Southern States during the past month. Meetings were held at Louisville, Knoxville, Atlanta, Birmingham, Hattisburg, New Orleans and Memphis.

The prime purpose of the meetings was to enable the officers of the National Association to become acquainted with the problems of the producers in that part of the country. At the same time opportunity was afforded for those in attendance to learn first hand what the National Association has accomplished for the industry since its organization in 1916.

Preliminary steps were taken at each place for the formation of local associations. Also, every firm attending the meetings who did not already belong, joined the National Association. Thirty-three new members were secured. All expressed enthusiasm over the program outlined by President Johnston and Mr. Sutton, the Business Manager, for bringing the sand and gravel business to a higher state of development and for assuring the future success of the industry.

After expressing his belief in the effective work that can be done by local associations, Mr. Sutton discussed the questions relating to specifications, freight rates and transportation. He dwelt at length on the provisions of the Esch-Cummins Bill that are in his opinion the cause of much of the transportation difficulties being experienced by sand and gravel producers today. He urged the necessity of the modification and repeal of some of the objectionable features of the law in order that the principle of equitable transportation privileges might be restored.

Mr. Johnston made a very inspiring appeal for the formation of state or district associations for the purpose of meeting local situations and demonstrated the necessity for the building up of a strong National Association in order to handle successfully, problems of national scope. His remarks were illustrated by striking examples of the benefits that have been derived through the activities of the state associations already organized and by the National Association.

The following is a list of producers in attendance at the various meetings:

Louisville, Ky., Sept. 14, 1920

John M. Settle—Ohio River Sand Co., Louisville, Ky.
I. J. Weaver—Ideal Supplies Co., Ludlow, Ky.
E. T. Slider—E. T. Slider, New Albany, Ind.
G. P. Walker—Tarco Const. Co., Cincinnati, Ohio.
Jas. L. Nugent—The Bedford-Nugent Co., Evansville, Ind.
H. Donnelly—Ohio Gravel Ballast Co., Cincinnati, Ohio.
J. B. Blanton—J. B. Blanton Co., Frankfort, Ky.
C. C. Slider—E. T. Slider Co., Louisville, Ky.
P. A. Yager—River Sand & Gravel Co., Owensboro, Ky.
H. H. Holliday—Holliday Sand Co., Cairo, Ill.
R. N. Nobbel—Ohio River Sand Co., Paducah, Ky.
W. L. Delker—River Sand & Gravel Co., Owensboro, Ky.
Henry Bohmer—Ohio River Sand Co., Louisville, Ky.
H. P. Caldwell—Ohio River Sand Co., Louisville, Ky.
J. H. Duffy—Ohio River Sand Co., Louisville, Ky.
Stanley A. Grobmyer—Grobmyer Sand & Gravel Co., Carrollton, Ky.
Jas. Gayle—Carrollton Sand & Gravel Co., Carrollton, Ky.
Thos. J. Duffy—Ohio River Sand Co., Louisville, Ky.
M. A. Neville—Western Indiana Gravel Co., Lafayette, Ind.
J. T. Duffy—Ohio River Sand Co., Louisville, Ky.
F. E. Hall—T. J. Hall & Co., Ohio River Sand & Gravel Co., Cincinnati, Ohio.
Chas. W. Bohmer—Ohio River Sand Co., Louisville, Ky.

Knoxville, Tenn., Sept. 15, 1920

A. T. Daniels—Daniels Sand & Building Co., Harriman, Tenn.
J. E. Foster—J. E. Foster Sand & Gravel Co., Lenoir City, Tenn.
S. C. Gates—Kinzel-Thompson Sand & Gravel Co., Knoxville, Tenn.
Alexander Harris—Holst Quarry Co., Knoxville, Tenn.
Ben Hirkins—Estill Sand & Gravel Co., Estill Springs, Tenn.
John R. Dickey, Jr.—Watauga Sand Co., Bristol, Va.
G. W. Chandler—Crescent Sand Co., Harriman, Tenn.
Oliver King—Oliver King Sand, Lime & Gravel Co., Knoxville, Tenn.
John H. Agee—Tennessee Lime & Sand Co., Knoxville, Tenn.
M. E. Thompson—Cherokee Sand Co., Knoxville, Tenn.
Milton McDermott—Knoxville Sand & Transp. Co., Knoxville, Tenn.
H. C. Milnor—Milnor Sand Co., Knoxville, Tenn.

Atlanta, Ga., Sept. 16, 1920

L. D. Oglesby—Tri-State Aggregate Co., Atlanta, Ga.
W. V. Devitt—Atlanta Crushed Stone Co., Atlanta, Ga.
J. A. Cassidy—The Southern Asphalt Ass'n, Atlanta, Ga.
W. D. Wilbanks—Lumber City Sand & Concrete Co., Lumber City, Ga.
K. M. Trowbridge—Acme Sand & Supply Co., Atlanta, Ga.
L. J. Downs—Downs Sand Co., Junction City, Ga.
J. S. Waterman—Chehaw Sand, Gravel & Mfg. Co., Atlanta, Ga.
A. D. Greenfield—Chehaw Sand, Gravel & Mfg. Co., Atlanta, Ga.
B. B. Taylor—Macon Sand Co., Macon, Ga.
R. R. Johnson—The R. O. Campbell Coal Co., Atlanta, Ga.
Albert E. Mayer—Acme Sand & Supply Co., Atlanta, Ga.
O. A. Nix—J. R. Hime Sand Co., Junction City, Ga.
G. C. Woodruff—Columbus Creek Gravel Co., Columbus, Ga.
E. W. Ellis—Lake Weir Washed Sand Co., Ocala, Fla.
T. M. Smiley—Smiley Sand & Gravel Co., Atlanta, Ga.
W. C. Harkey—W. C. Harkey Sand Co., Mauk, Ga.
J. L. Cheves—Allon Sand Co., Inc., Zenith, Ga.
C. C. McCarty—Allon Sand Co., Inc., Ft. Valley, Ga.
L. E. Morningstar—Morningstar Sand Co., Junction City, Ga.
A. P. Burke—Atlanta Sand & Supply Co., Atlanta, Ga.
Alex Harris—Chattanooga, Tenn.

Birmingham, Ala., Sept. 17, 1920

W. L. Canada—Cook and Laurie Gravel Co., Montgomery, Ala.
Paul Roeder—Hugger Bros. Gravel Co., Montgomery, Ala.
R. N. Hawkins—Kirkpatrick Sand & Cement Co., Birmingham, Ala.
J. S. Underwood—The Underwood-Walker Co., Birmingham, Ala.
John M. Heath—Georgia Commercial Sand Co., Talbotton, Ga.
O. A. Nix—J. R. Hime Sand Co., Junction City, Ga.
K. M. Trowbridge—Acme Sand & Supply Co., Atlanta, Ga.
W. D. Lewis—Premier Sand & Gravel Co., Birmingham, Ala.
R. P. Prowell—R. P. Prowell, Tuskaloosa, Ala.

Hattiesburg, Miss., Sept. 18, 1920

J. J. Haney—New Inland Gravel Co., Hattiesburg.
N. W. Rocket—Dixie Gravel Co., Hattiesburg.
L. E. Faulkner—New Inland Gravel Co., Hattiesburg.
H. F. Wheeler—Dixie Gravel Co., Hattiesburg.
S. O. Trest—Dixie Gravel Co., Hattiesburg.
I. V. Austin—Dixie Gravel Co., Hattiesburg.
G. B. Harris—Simpson County Gravel Co., Saratoga, Miss.

New Orleans, La., Sept. 20, 1920

Fordyce Kimbell—Mgr. State Traffic Ass'n, New Orleans.
Walter Jahncke—Jahncke Service, Inc., New Orleans.
P. M. Perkins—Pelican Gravel Co., Le Compte, La.
George K. Force—New Orleans Gravel Co., Inc., New Orleans.
F. G. Womack—Womack & Kent, Kentwood, La.
W. A. Weaver—Jahncke Service, New Orleans.
J. J. Haney—Hattiesburg, Miss.
A. D. Alderson—New Orleans.
R. A. Thompson—New Orleans.
C. F. Peterson—J. W. Thompson Co., New Orleans.
Otto Schwartz—American Brick Co., Inc., New Orleans.

Memphis, Tenn., Sept. 21, 1920

W. H. McDonald—Memphis Stone & Gravel Co., Memphis, Tenn.
S. K. Jones—Contractor, Memphis, Tenn.
W. E. Gamewell—Memphis Stone & Gravel Co., Memphis, Tenn.
A. C. Butterworth—Southern Sand Co., Little Rock, Ark.
L. S. McDonald—Arkansas Traffic Ass'n, Little Rock, Ark.
John I. Foules—Mo. Portland Cement Co., Memphis, Tenn.
J. A. Lehaney—Mo. Portland Cement Co., Memphis, Tenn.
H. E. Myers—Galley-Myers Co., LaGrange, Tenn.
Fred Callahan—Attorney, Memphis, Tenn.
A. J. Donelson—Attorney, Memphis, Tenn.
W. H. Rucker—New Hope Gravel Pit, Itta Bena, Miss.
G. B. Harris—Simpson County Gravel Co., Saratoga, Miss.
George W. Fooshe—Allen Gravel Co., Memphis, Tenn.
Ashleigh Harleston—Ashleigh Harleston, Askew, Miss.
W. J. Kearney—Speed & Kearney, Memphis, Tenn.

It is the purpose of officers of the National Association to arrange for meetings in every part of the United States previous to the Annual Convention which will be held about the middle of January.

The tentative schedule for the next series of meetings is as follows:

Alexandria, La., October 9.

Houston, Texas, October 11.

San Antonio, Texas, October 12.

Dallas, Texas, October 13.

Tulsa, Okla., October 14.

Editorial Comment

Rock Products Fertilizers

Exception has been taken by a prominent geologist to the statements made in ROCK PRODUCTS of September 11 on the subject of natural rock fertilizers. Most assuredly the editorial in question was lacking in completeness for want of space. There is one omission that does perhaps result in a misleading impression, and that is the one referred to in the letter of the Maine state geologist, printed elsewhere in this issue.

Of course every novice knows that the presence of humus in the soil is essential to most plant life. The humus is the carrier of those micro-organisms which some scientists believe are the keys to all forms of life. It is indeed possible to have the most perfect mineral combination of soil, but to have it sterile until these soil microbes are present. Humus was not mentioned particularly in the editorial in question, although this was in mind when water, drainage, etc., were referred to.

There is some reason to question whether humus is the *cause* of soil fertility or the *result* of soil fertility. For instance, it is well known that limestone soils soon become rich in humus because deep-rooted plants, like clover and alfalfa, seek these soils. Thousands of acres of land in the far west, formerly known as desert land, arid and parched, devoid of humus as the sea-shore sand, have become wonderfully fertile by the mere introduction of water and the growing of crops like alfalfa. Certainly this would make it seem that humus was the result rather than the cause of soil fertility.

The sum and substance of the matter is that little is actually known of the processes of natural soil chemistry. That the process of converting powdered rock into available plant food through the means of soil bacteria, or microbes, is too slow to be practical is by no means conclusively proved. In fact, the whole field of rock fertilizers offers wonderful opportunities for developing new facts.

As an example of the character of experiments from which present conclusions have been drawn take rock phosphate. Several experimenters have condemned its use because, it was claimed, the results with certain crops were not equal (dollar for dollar) to those obtained with acid phosphate. These experimenters did not take into account the fact that the soils on which the tests were carried out were also much in need of sulphur and that the results obtained could have as easily been accounted for by the sulphur in the acid phosphate as by the phosphorus. The same experiments repeated with the rock phosphate and ground raw *gypsum* rock (to furnish the sulphur) might have led to entirely different conclusions. Likewise in the case of potash-bearing silicates. Used alone in certain soils and with certain crops it is likely that the potash is very slowly, if ever, available. On the other hand used in connection with ground gypsum rock and with certain crops, Dr. Crocker, of Chicago University, has proved that the potash-bearing slates, for instance, are made quickly available for plant food.

What the rock products industry needs is a new line of thought and action in regard to fertilizer tests. There is too much antagonism and too much prejudice against new ideas or experiments designed to develop new facts rather than to prove or disprove preconceived theories. The propaganda of the commercial fertilizer industry has had a tremendous effect, unconscious in many instances perhaps, in prejudicing agricultural experts against the use of many products which nature has supplied in abundance, and which need only simple mechanical treatment and the chemical processing which nature's own means can supply, if all conditions are made favorable for the work.

Prices of Materials

The downward trend of prices of clothing, automobiles, etc., is not reflected to any extent in the case of building materials and rock products generally. The result is a howl in some quarters, particularly in New York, against profiteering in building materials. Alleged excessive prices of building commodities are to be investigated and, according to newspaper clatter, the profiteers are to be jailed.

The *building material producers* smile at these charges and will no doubt welcome the investigators with open arms. They will be only too glad to have the authorities learn something about the difficulties they have had to contend with this year of 1920. When it is all over, both the investigators and the public should be better informed and have more respect for the manufacturers of basic building commodities.

To anyone who has read the review of conditions in the rock products industry summarized in ROCK PRODUCTS of August 28, the idea that prices of building materials in general are excessive will seem absurd. As a matter of fact, most producers are wondering where they are going to get back their outlay for this year's operation.

A personal investigation of conditions in the East shows that shortage of labor and shortage of transportation have curtailed production beyond reason. While the transportation situation appears to be gradually improving, the labor situation is still a limiting factor and seems likely to remain so for a long time to come. Add to these troubles the scarcity and high cost of fuel, which enters so largely into the production of all basic building materials, and present prices of building materials, to those who are familiar with all these details, seem abnormally low.

Conveyor Hazards and How To Minimize Them

(Prepared for "Rock Products" by the engineering staff of the National Safety Council)

THIS is the concluding article of a series on conveyor hazards.

Screw Conveyors

The principal danger in the operation of spiral screw-conveyors is that of the workmen getting their hands or feet caught in the conveyor. Never under any condition should an attempt be made to loosen material in a screw conveyor trough without first shutting off the power, nor should any attempt be made to repair a conveyor trough while the conveyor is in operation. It is suggested that a warning sign "SHUT OFF POWER BEFORE LOOSENING MATERIAL," be placed over openings in conveyor troughs.

All conveyor troughs should be completely covered over. The covers are ordinarily made in removable sections for purposes of inspection and convenience in dislodging choked material. One member of the National Safety Council has taken the precaution to provide double covers for their conveyor troughs. A second cover made of heavy wire mesh is placed underneath the solid top. This wire mesh cover is made in removable sections corresponding in size to the top cover sections. The screen covering underneath will permit of inspection and still guard the screw. It may be removed when necessary.

Frequently the charging doors to screw conveyor troughs are not properly guarded, and a workman may carelessly step into them and be injured. In every case the charging stations should be grated over with a substantial grating, or else properly boxed in to a sufficient height so that workmen cannot step into them.

The driving gears at the end of conveyor troughs should be entirely enclosed.

Aerial Cableways

Aerial cableways are frequently used on large construction jobs, such as irrigation dams, for conveying concrete, rock and other materials. They are used also to some extent for quarries and rock handling equipment. The principal hazards in their use are falling material, injury to workmen inspecting and oiling the cables and carriage, and misunderstanding of signals.

No attempt should be made to carry on work directly underneath the tramway, except of course at the loading and unloading stations where exceptional precautions should be taken. Wherever it is necessary for workmen frequently to pass underneath the tramway it is suggested that a covered passageway be provided.

The equipment should be regularly and frequently inspected with special attention to the sheave wheels and bearings, the cable fastenings, the bucket latch and trunnions, and all load sustaining parts. All cables should be kept well oiled both for purpose of lubrication and for protection against the weather.

It is of much importance that a dependable and sure method of signalling be had wherever men must work at the loading or unloading stations. A telephone or electric push-button system is advisable.

Open Switches and Fuses Should Be Guarded for Safety

ELECTRIC SWITCHES AND FUSES which are not enclosed are dangerous, as it is comparatively easy for men working around them to come in contact with exposed parts of a live circuit. Blow-outs of fuses and flashes, if anything goes wrong with the equipment, are ever present sources of danger if no covering is provided.

One day, when a motor in a certain plant refused to start, a repairman was called upon to locate the trouble. This man tried the starter handle, which appeared to be in working order, but a pin had dropped out unknown and the electrician consequently did not know he left the circuit of the starter closed. When he closed the switch, which was enclosed in a metal box and could be operated without opening the box, there was a flash and the door was blown open with great force, bruising the man's face just over the eye.

Had there been no box the man would have been severely burned and possibly would have lost his sight. Had the box been locked the material would have withstood the flash and the man would not have received even a scratch. The electrical department had started the day before to provide locks for these boxes and had completed this work up to this very department. Grounding of the metal box saved the man from a severe shock.

There are several good switch boxes on the market which are so constructed that the switch can be thrown without opening the box. An excellent feature has been added to some of these boxes in that under ordinary conditions it is impossible to open the switch box door without pulling the switch, and the door must be closed before the switch can again be thrown in. A quick make-and-break attachment is also a good feature added to many switch boxes. The necessity of making a close investigation of switch boxes before buying can not be too strongly emphasized. Many boxes, although they serve to cover the switches and fuses, have proved to be very unsatisfactory in actual service. When buying safeguards it pays to get the right equipment the first time.—"Accident Prevention Bulletin" of the Portland Cement Association.

The First Run of the 1921 Safety Calendar Is Ready for Distribution

Size 10⅞x18 in.

Each month of the calendar is printed on a separate sheet, with a clever, high-grade, three-color illustration at the top of each. Twelve humorous pictures, each driving home forcibly its own safety message.

Hazards common both to the home and the factory—serious because of the frequency of the accidents which they cause—are the subjects around which these illustrations are built.

This calendar offers a splendid opportunity to round out safety instructions given to the man in the shop by carrying the message into his home, to his wife, and to his children, and through them, back to him.

National Safety Council

Co-operative—Non-commercial

168 North Michigan Avenue, Chicago, Ill.

NEW MACHINERY AND EQUIPMENT

New Method of Stripping Overburden

THE USUAL METHOD of hauling overburden away is by locomotives and trains of dump cars to spoil dumps, but the advent of a new device recently installed by the Florindin Co., of Quincy, Fla., to remove overburden from Fullers earth deposits, materially reduces labor, equipment and time required to accomplish the same result.

The equipment is designed and built by the Hamilton Manufacturing Company of Columbus, Ohio, and consists of a portable stripping machine moving by its own power and working in conjunction with any ordinary steam shovel. By the Hamilton machine and system the overburden is removed by another shovel, and as the work proceeds, the overburden from the next cut is wasted into the space from which the vein of clay has been removed.

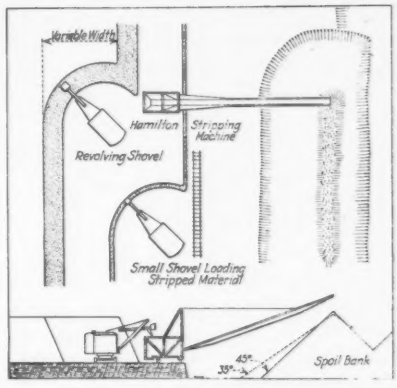
This portable stripping machine has a hopper located to receive the discharge from the shovel dipper at the most advantageous height and angle and as the machine moves with its own power, it is independent of the shovel, but at the same time it is its constant attendant, and always ready to receive and dispose of all the shovel can give it.

This ever readiness to take all the shovel can give it; increases the capacity of the shovel, and entirely eliminates the delays heretofore incident to waiting for cars in return from the dump pile, for temporary tracks to be laid and cars spotted thereon, and thereby the shovel's capacity is augmented some fifty per cent over its average yardage when forced to wait on the spotting of dump cars, etc., and trains traveling back and forth.

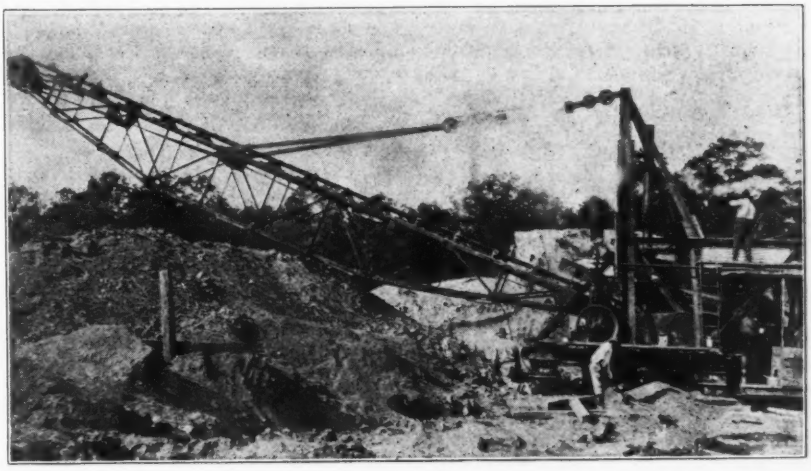
In the accompanying line drawing and photographs it will be seen that the location of the hopper on the machine reduces the swing of the shovel one-fourth as compared with the swing necessary to dump into a car, the large opening of the hopper and its fixed height and position with reference to the shovel, makes the work of the shovel runner more easy, regular and sure. This machine does not have to be moved up every time six yards are put into it. The shovel man learns the position of the hopper on the first swing of his dipper and does not have to "feel" for it every swing, as is the case when filling dump cars where spilling on the track is likely to derail the train.

As the work of all shovels divides itself into 20% digging time and 80% swinging and dumping time, if we reduce the swinging and dumping time 25%, we increase the shovel's efficiency twenty-five per cent and in dispensing with the use of dump cars and dinkey locomotives, and the large gangs of laborers required to lay and shift tracks, all this expense is eliminated with the inevitable delays in waiting, spotting and dumping cars, track shifting, this means another 25 to 50% of shovel time saved.

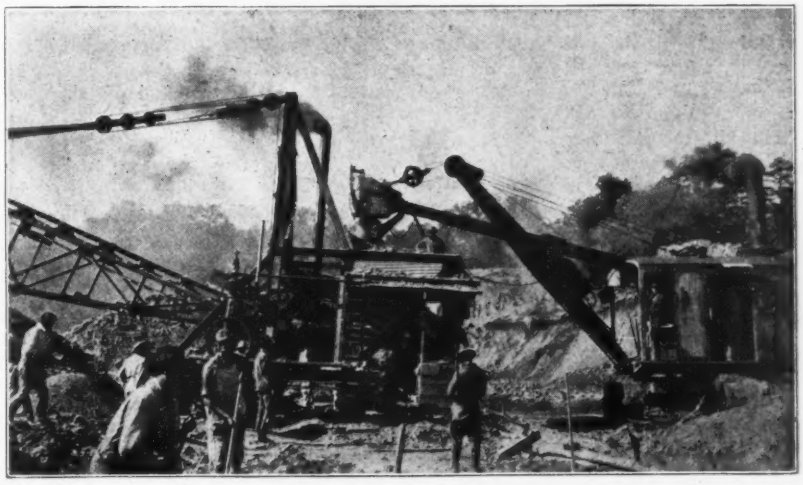
The increased yardage from the shovel will pay the operating cost of the stripping conveyor as shown by the following statement of costs of the two methods at a typical operation where more men were used on the stripping conveyor than would be needed ordinarily.



Typical operation of Hamilton stripping conveyor



Stripping conveyor and hopper



Steam shovel depositing in hopper

General News from Rock Product Markets

Blue Diamond Plaster Co. Purchases White Star Plaster Co. for Quarter Million Dollars

THE Blue Diamond Plaster Co., of Los Angeles, Calif., has purchased the large plant and properties of the White Star Plaster Co., situated at Arrowhead, near Las Vegas, Nev. The purchase price approximates a quarter million dollars. Additional equipment for $30,000 is being installed, as it is the intention of the new company to double the output of the plant—from 100 to 200 tons per day—expecting to be ready for operations in the near future. This plant covers one section of land containing large deposits of gypsum, and it is said to be one of the largest in the West, the opinion of geologists being that this is the largest deposit of its kind known in the Western United States. A sufficient supply of plastering material for local use is assured by the purchase of this tract.

Rock Products Fertilizers

SIR—May I be pardoned for suggesting that the editorial on Rock Products Fertilizers, in your issue of Sept. 11, is in some particulars a trifle misleading?

One might with justice criticise the statement that quartz (silica) is useless to plants. This, however, does not affect the main argument.

My quarrel is chiefly with the first sentence and with the last sentence in the last paragraph but one.

The soil of the earth is not strictly composed of disintegrated rocks; rather of the partially decomposed and altered products of rock disintegration plus, in most cases, certain matters which result from the decomposition of the remains of organisms. It is by no means certain that a soil formed of fresh rock material, however finely comminuted, or however rich in the elements essential to plant growth, would by itself constitute a successful medium for the production of crops.

So with the statement: "These materials furnish the calcium, phosphorus, sulphur and potassium in the state they are found in all naturally rich soils." Is this statement exactly accurate, or wholly fair? Are we to ignore the chemical, mechanical and organic agencies which have, acting through long periods of time, gradually altered the rock-derived materials to forms available to plant use?

It may be argued that these same agencies will act upon freshly ground minerals and thus render them available. This is true, but the action is too slow. Immediate results are demanded of a fertilizer, as well as permanent results.

The editorial would seem to indicate the need of toleration, and moderation, on both sides.

The case of ground limestone against hydrated lime seems well sustained. I think, however, we may be pardoned for hesitating to assume that untreated rock phosphate and ground feldspar (or other silicate material containing potash) will produce immediate, or early future, results comparable to those produced by phosphates and potash in more available form.

I agree heartily with the proposition that we have paid too much attention to immediate returns, and too little to permanent fertility. Are we, however, likely to help matters by, however unintentionally, misstating the facts?

FREEMAN F. BURR,
Acting State Geologist.

Augusta, Maine, Sept. 16, 1920.

National Association Sand and Gravel Producers Protest Latest Order of I.C.C.

IN A STATEMENT issued on Sept. 27 the National Coal Association says that every effort is being made by the bituminous coal operators to obtain a weekly production of 12,000,000 tons between now and Dec. 1. Failure to attain that output in the past months is attributed entirely to car shortage, the coal association maintaining that thousands of cars that should be carrying coal are being used for the shipment of other commodities.

Closely following the issuance of this statement by the coal operators, the car service division of the American Railroad Association is reported as being responsible for orders promulgated by a number of railroads operating in the Central states, denying the use of open-top cars for sand and gravel loading for a period of 10 days, beginning Oct. 1. Some of the railroads that have put out such instructions still permit the use of cars less than 38 inches high, while others do not.

It may be assumed that, as in former instances, this recent action of the American Railroad Association is sanctioned by the Interstate Commerce Commission, though no public announcement has been made to that effect.

The Washington Bureau of the Daily Traffic World, issue of Oct. 2, makes the following comment under the heading, "Cars for Coal":

"Instead of relaxation of the terms of Service Order No. 7—the one reserving open-top cars for coal service—there is more likelihood of its being made more drastic by the elimination of the permission to load coal cars with other freight moving in the direction of the mines."

It is feared, therefore, that the orders previously referred to, which now appear local in their scope, may be made to include all railroads east of the Mississippi River and be extended for an indefinite period of time. If this latter contingency should arise, no doubt similar restrictions will be imposed west of the river in order to hasten the movement of empty open cars eastward to the bituminous fields.

E. Guy Sutton, business manager of the National Association of Sand and Gravel Producers, is in Washington for the purpose of investigating the matter. Vigorous protest will be made against any further restrictions being placed on sand and gravel loading.

Road Work in Carolina

SINCE work began in the spring of 1919, under the direction of the North Carolina Highway Commission, says a Raleigh special, work has been finished, or is in progress on 508 miles of hard-surface and gravel roads, the cost of these to total $7,327,835, including bridges, and covering seventy-three projects, these being in 55 of the 100 counties. The cost of the work has risen very greatly recently. Most of the contracts were let at $1,486 for hard-surface roads, (127 miles) and at $8,495 for gravel roads. Now the cost is $40,000 and $10,000 in round figures. Owing to the railway embargo on stone, many contractors are shutting down work.

Cars for Fertilizer Shipments

THE car service division of the American Railway Association, under date of September 27, issued Supplement No. 1 to Circular CCS-56, canceling instructions contained in Circular CCS-56, issued July 16, and providing a 75 per cent car supply for fertilizer shipments.

"It should be understood that further shipments of this material shall be accorded full pro rata share of all available cars," the supplement states.

New Type Motor Driven Safety Car Puller

THE Stephens-Adamson Mfg. Co., of Aurora, Ill., has just issued a new bulletin, which illustrates and describes several different types of motor driven safety car pullers manufactured by the company. These machines are adapted to uses about industrial plants where railroad cars are to be shifted on switch tracks. They are simple and safe to operate and very economical for the reason that they only use 7½ H. P. when actually in use, and there is no power consumption, of course, when the machine is not being operated.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Bound Brook, N. J.	2.00	2.25	2.00	1.80	1.60	.....
Buffalo, N. Y.			1.40 per net ton, all sizes			
Burlington, Vt.	1.00	.....	2.50	2.00	2.00	.....
Chaumont, N. Y.	1.75	1.75	1.75	1.50	1.50	1.50
Coldwater, N. Y.	1.80	1.80	1.80	1.65	1.65	2.00@2.25§
Grove, Md.	1.45	2.50	2.40	2.00	1.60	1.45
North Leroy and Akron, N. Y.	1.00	1.00	1.00	1.00	1.00	1.00‖
Utica, N. Y.	1.00		All other sizes 1.50			
Vernoy, N. J.	2.00	2.25	2.00	1.80	1.60	.....
CENTRAL						
Alden, Ia.	1.00	.....	1.50	1.45	1.45	.....
Alton, Ill.	2.50	.....	2.00	1.75	.....	.....
Bettendorf, Ia.			All sizes, 1.75 cu. yd.			
Buffalo, Ia.	.90	1.35	1.45	1.25	1.25	1.35
Chicago, Ill.	1.58	1.90	1.70	1.58	1.58	1.58
Cincinnati, Ohio	.....	2.00	2.00	2.00	.....	.....
Cleveland, Ohio	.....	2.40	2.20	2.20	.....	.....
Columbia, Ill.	2.15	1.90	2.00	2.00	1.90	1.90
Davenport, Ia.	1.50*	1.50*	1.50*	1.50*	.....	.....
Dundas, Ont.	.75	1.50	1.50	1.35	1.25	1.20
Eden and Knowles, Wis.	1.30	1.30	1.30	1.30	1.30	.....
Elmhurst, Ill.	1.00@1.25	1.00@1.25	1.00@1.25	1.00@1.25	1.00@1.25	1.00@1.25
Ft. Wayne, Ind.	1.60	1.90	1.90	1.80	1.60	1.60
Greencastle, Ind.	1.25@1.50	1.35	1.25	1.10@1.20	1.10	1.10
Hull, Canada	2.50	2.30	2.50	2.10	2.00	1.75
Illinois, Southern	2.00	1.75	1.75	1.75	1.75	.....
Kansas City, Mo.	.60	2.00	.....	.....	.....	.....
Kokomo, Ind.	1.10	1.10	1.25	1.20	1.10	1.10
Lannon, Wis.	1.25	1.25	1.25	1.25	1.25	1.25
Lima, Ohio	1.70	1.60	1.50	1.50	1.50	1.50
Linwood, Ia.	1.00	.....	1.45	1.25	1.25	.....
Mansfield, Ohio	1.70	2.20	2.00	1.90	1.70	1.70
Mayville, Wis.	.95@1.00	.....	1.20	1.20	1.20	1.20
Montrose, Ia.	1.25	1.80	1.80	1.70	1.70	.....
Ottawa, Can.	3.00	3.25	3.40	2.75	2.50	.....
River Rouge, Mich.	1.25	1.50	1.50	1.50	1.25	1.25
St. Louis, Mo.	.60	1.60	.....	.....	.....	.....
Stone City, Ia.	.80	.....	1.60	1.50	1.40	.....
Toledo, Ohio, f. o. b. cars	1.85	2.10	2.10	2.10	1.85	1.85
Toronto, Canada	1.55	2.25	2.25	2.25	2.05	2.00
SOUTHERN:			These prices include 90c freight			
Cartersville, Ga.	2.50	2.50	2.50	2.75	2.75	2.50
Chickamauga, Tenn.	1.50	1.75	1.75	1.75	1.75	1.75
Columbia, S. C.	1.00	3.75	.....	3.50	.....	.....
El Paso, Tex.	1.00	1.00	1.00	1.00	.....	.....
Fort Springs, W. Va.	1.75	2.00	1.90	1.80	1.60	1.50
Garnett, Okla.	.65	.....	1.75	1.75	1.60	.....
Mascot, Tenn.	.....	1.50	2.00	.....	1.50@2.00	.....
New Braunfels, Tex.	.60	1.75	1.75	1.50	1.50	1.50
WESTERN:						
Atchison, Kans.	.50	.....	2.10	2.10	2.10	.....
Blue Springs and Wymore, Neb.	.20	1.95	1.95	1.85@1.90	1.75@1.80	1.70
Kansas City, Mo.	.60	2.00	.....	.....	.....	.....
Duluth, Minn.	1.00	2.25	2.00	1.50	1.50	1.50
Terminous, Calif.	.....	1.00	.....	.....	.90	.....

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Bernardsville, N. J.	2.00	2.20	2.00	1.80	1.50	.....
Branford, Conn.	.80	1.75	1.65	1.45	1.25	.....
Birdsboro, Pa.	1.40	1.90	1.80	1.60	1.40	1.40
Bound Brook, N. J.	2.10	2.30	2.00	1.85	1.70	.....
Dresser Jct., Wis.	.75	2.45	2.45	2.15	2.00	2.00
Duluth, Minn.	1.00	2.50	2.00	1.50	1.50	1.50
E. Summit, N. J.	2.10	2.35	2.15	1.85	1.80	.....
Glen Mills, Pa.	1.90	1.90	1.90	1.90	1.90	1.90‖
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60@1.00	1.60@1.80	1.60@1.80	1.40@1.50	1.20@1.30	.....
San Diego, Calif.	.....	1.30@1.60	1.25@1.55	1.15@1.45	1.10@1.40	.....
Westfield, Mass.	.60	1.35	1.30	1.20	1.10	.....
Richmond, Calif.	.50	.....	1.50*	1.50*	1.40*	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Dundas, Ont.—Flint	1.10	1.10	1.10	1.10	1.10	1.10
Middlebrook, Mo.—Granite	4.00	.....	2.00	.....	.....	1.50‡
Ottawa, Can.—Granite	5.50	5.00	5.50	5.00	.....	.....
Portland, Maine—Granite	1.50	.....	.....	1.35	1.25	.....
Stockbridge, Ga.—Granite	.50	2.00	1.90	1.75	1.75	.....
White Haven, Pa.—Sandstone	.85	1.20	1.40	1.20	1.20	1.20‖
Granite	1.25	.....	1.50	1.50	1.50	.....

*Cubic yard. †Agrl. lime. ‖R. R. ballast. §Flux. ‡Rip-rap. a 3-inch and less.

Agricultural Limestone

EASTERN:

Coldwater, N. Y.—Analysis, 56.77% $CaCo_3$, 41.74% $MgCo_3$—70% thru 200-mesh, 95% thru 40-mesh; bags, $5.00; bulk **3.25**

Chaumont, N. Y.—Analysis: $CaCo_3$, 92 to 98%; $MgCo_3$, 1.51%—(Thru 100 mesh); sacks, 4.00; bulk 2.50

Gasport, N. Y.—50% thru 50 mesh 3.25

Grove City, Pa.—Analysis: $CaCo_3$, 94.75%; $MgCo_3$, 1.20%—(70% thru 100 mesh); 80 lb. ppr., 5.50; bulk 4.50

Grove, Md.—(50% thru 50 mesh); paper bags, 6.75; bulk 5.00

Hillsville, Pa.—Analysis, $CaCo_3$, 96% (70% thru 100 mesh); sacks, 5.00; bulk 3.25

Jamesville, N. Y.—68% thru 100 mesh; 95% thru 50; 100% thru 20. Sacks, 3.75; bulk 2.25

Syracuse, N. Y.—Analysis, 90% carbonates (50% thru 100 mesh, 90% thru 50 mesh); sacks, 3.50; bulk 2.75

Walford, Pa.—(70% thru 100 mesh; 85% thru 50; 50% thru 50; 100% thru 4); sacked, 4.25; bulk **2.75**

West Stockbridge, Mass.—Analysis: Combined carbonate, 95%—33% thru 200 mesh; 66% thru 100; 100% thru 40. Bulk 2.85

Williamsport, Pa.—Analysis, $CaCo_3$, 88-90%; $MgCo_3$, 3-4%—(50% thru 50 mesh); sacks, 5.50; bulk 4.00

CENTRAL:

Alden, Ia.—Analysis, $CaCo_3$, 99.16% ..... .80

Alton, Ill.—Analysis: $CaCo_3$, 96%; $MgCo_3$, 0.75%—50% thru 4 mesh 2.50

Bedford, Ind.—(95% thru 10 mesh) Analysis, $CaCo_3$, equivalent 98.5% 2.00

Belleville, Ont.—Analysis, $CaCo_3$, 90.9%; $MgCo_3$, 1.15% (45 to 50% thru 100 mesh; 61 to 70% thru 50 mesh); bulk 2,50

Chicago, Ill.—Analysis, $CaCo_3$, 53.63%; $MgCo_3$, 37.51%—90% thru 50 mesh 1.00

Columbia, Ill., near East St. Louis (½-in. down) ..... 1.25@1.80

Elmhurst, Ill.—(Analysis, $CaCo_3$, 35.73%; $MgCo_3$, 20.69%) 50% thru 50 mesh 1.25

Greencastle, Ind.—(Analysis $CaCo_3$, 98%), 100% thru 10 to 12 mesh 2.00

Howenstein, O.—100% thru 10 mesh; 59% thru 50; 39% thru 100 ..... 2.75@3.00

Kansas City—(50% thru 50 mesh) **2.00**

Lannon, Wis.—(90% thru 50 mesh) Analysis, 54%, $CaCo_3$; 44%, $MgCo_3$ 2.00

Marblehead, O.—(Analysis: $CaCo_3$, 95.33%) 100% thru 100 mesh, sacks, 5.25; bulk 3.00

McCook, Ill.—Analysis, $CaCo_3$, 54.10%; $MgCo_3$, 45.04%—100% thru ¼-in. sieve; 78.12% thru No. 10; 53.29% thru No. 20; 38.14% thru No. 30; 34.86% thru No. 50; 22% thru 100 ..... **1.50**

Milltown, Ind.—Analysis, $CaCo_3$, 93.10%; $MgCo_3$, 3.20%—(70.8% thru 20 mesh) 1.65

Montrose, Ia.—(90% thru 100 mesh) **1.25**

Piqua, O.—Analysis: $CaCo_3$, 82.8%; $MgCo_3$, 8.2%; neutralizing power in terms of calcium carbonate, 95.3%—
50% thru 100 mesh ..... 3.50@5.50
50% thru 50 mesh ..... 2.00@4.00
50% thru 4 mesh ..... 1.75@2.00

Ridgeville, Ind.—(Analysis $CaCo_3$, 98%), 100% thru 4 mesh 1,75

Stolle, Ill. (near East St. Louis on I. C. R. R.)—(Thru ¼" mesh) Analysis, $CaCo_3$, 89.61 to 89.91%; $MgCo_3$, 3.82% 2.00

St. Paul, Ind.—Analysis, $CaCo_3$, 85%; $MgCo_3$, 12% 1.50

Stone City, Ia.—Analysis, $CaCo_3$, 98% (50% thru 100 mesh) ..... **.80**

Toledo, O.—Analysis, $CaCo_3$, 52.72%; $MgCo_3$, 43%—(20% thru 100 mesh); 30% thru 50; 80% thru 100; 100% thru 5/32 screen) **1.80**

Whitehill, Ill.—Analysis, $CaCo_3$, 96.12%; $MgCo_3$, 2.50%—
50% thru 100 mesh 5.00
50% thru 50 mesh 5.00

(Continued on next page.)

Agricultural Limestone

(Continued from preceding page.)

SOUTHERN:

Cartersville, Ga.—Analysis: 96% combined carbonates—All thru 10 mesh with all dust in 3.00

Claremont, Va. (Marlime)—Analysis, 90.94% $CaCo_3$, 0.31% P., 1.36% Mg., 0.37% K.; bulk 4.50
100 lb. ppr. bags 6.00
100 lb. cloth bags 6.50

Dittlinger, Tex.—Analysis, $CaCo_3$, 99.09%; $MgCo_3$, .04%.
90% thru 100 mesh 2.00
90% thru 4 mesh 1.00
50% thru 100 mesh) 2.50

Grovania, Ga.—Analysis, $CaCo_3$, 95%; $MgCo_3$, none—50% thru 100 mesh.... 3.00

Hopkinsville, Ky.—Analysis, 94.6 to 98.1% $CaCo_3$—Bulk 2.00

Knoxville, Tenn.—Pulverized 2.50
90% thru 100 mesh 3.00

Linnville Falls, N. C.—Analysis, $CaCo_3$, 53%; $MgCo_3$, 42%—50% thru 100 mesh; sacks, 4.50; bulk 3.00

Marion, Va.—Analysis, 90% $CaCo_3$—(50% thru 100 mesh) 2.50

Memphis Jct., Ky.—(Analysis, $CaCo_3$, 95.31%; $MgCo_3$, 1.12%); average price, ½ in. down 2.00

Mascot, Tenn.—Analysis, $CaCo_3$, 52%; $MgCo_3$, 38%.
(80% thru 100 mesh) 3.00
(All thru 10 mesh) 2.50
(80% thru 200 mesh) 5.00
Paper bags, $1.50 extra per ton; burlap, 2.00 extra per ton.

Maxwell, Va. 2.50

Mountville, Va.—Analysis, $CaCo_3$, 76.6%; $MgCo_3$, 22.83%—100% thru 20 mesh; 100 lb. ppr., 7.00; bulk 5.00

Ocala, Fla.—Analysis, $CaCo_3$, 98%—(75% thru 200 mesh) 4.50

Tyrone, Ky.—Analysis, $CaCo_3$, 90%; $MgCo_3$, 4%—90% thru 4 mesh ..... 1.75@2.25

WESTERN:

Cement, Calif.—Analysis, $CaCo_3$, 95%; $MgCo_3$, 2%—(50% thru 50 mesh) 5.00

Colton, Calif.—Analysis: $CaCo_3$, 95%; $MgCo_3$, 1½% (all to pass 14 mesh)—bulk, 3.50; bags 4.50
Sacks, 15c extra, returnable.

Kansas City, Mo., Corrigan Sid'g—50% thru 50 mesh; bulk 1.35

Terminous, Calif.—Analysis, 94% $CaCo_3$, 1.4% $MgCo_3$—(60% thru 200 mesh; 90% thru 100 mesh; 100% thru 40 mesh); sacks, 6.00; bulk 5.25

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

GLASS SAND:

Berkeley Springs, W. Va. ..... 2.75@3.25
Bridgeton, N. J.—Washed, 2.50; dried 3.00
Cedarville and South Vineland, N. J.—Damp, 2.00; dry 2.50
Columbus, Ohio ..... 2.50@3.00
Gray Summit, Mo. ..... 2.50@3.00
Guion, Ark.—Carlots 2.50
Hancock, Md.—Damp 2.00
Klondike and Pacific Mo. ..... 2.50@3.00
Mapleton, Pa.—Dry 4.00
Glass, damp 3.00
Massillon, Ohio 3.50
Millington, Ill. ..... 2.25@3.00
Mineral Ridge, Ohio 4.00
Montoursville, Pa.—Green, washed ..... 2.00@2.75
Morgantown, W. Va. ..... 2.50@3.00
Oregon, Ill.—Large contracts ..... 2.00@2.50
Ottawa, Ill. 2.50
Pittsburgh, Pa.—Dry, 4.00; damp 3.00
Robinson, Md.—Washed, damp 2.00
Rockwood, Mich. ..... 3.00@4.00
St. Marys, Pa.—Green 3.00
Sands, Elk Co., Pa.—Selected, green 3.00
Thayers, W. Va.—Washed 3.00
Tygarty, Ky.—Washed, not dried 2.60
Utica, Ill. ..... 1.75@2.50

FOUNDRY SAND:

Albany, N. Y.—Core 2.00
Molding fine and coarse ..... 3.00@3.50
Sand blast ..... 6.00@8.00
Brass molding ..... 3.00@4.00
Allentown, Pa.—Core ..... 1.50@1.75
Molding coarse 1.50
Arenzville, Ill.—Molding fine ..... 1.80@2.25
Beach City, Ohio—Core ..... 3.00@3.50
Furnace lining ..... 3.00@3.50
Molding fine and coarse ..... 3.00@3.50
Sand blast ..... 3.50@4.00
Bowmantown, Pa.—Core ..... 1.35@1.50
Molding, coarse ..... 2.00@2.40

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Ambridge, South Heights, Pa.	.....	**1.30**	.....	**1.30**	**1.00**	1.00
Attica, N. Y.	**.75**	**.75**	**.75**	**1.00**	**1.00**	1.00
Farmingdale, N. J.	.48	.48	1.70	1.70	1.40	1.40
Hartford, Conn.	**.90**	.....	**1.25**	**1.15**	**1.15**	1.15
Leeds Junction, Me.	.....	**.50@ .60**	**1.75@2.00**	**1.50**	.....	**1.35**
Ludlow, Mass.	.75*	.75*	1.70	.....	1.50*	1.50*
Washington, D. C.	.75	.75	2.00	1.40	1.20	1.20
York, Pa.	.....	1.20@1.30	(crushed gravel)			
CENTRAL:						
Alton, Ill.	.60@ .75	.60@ .75	1.50@4.50	1.30	1.20	1.20
Anson, Wis.	.....	.60@ .70	.....	**1.25@1.50**	.....	1.00@1.15
Attica and Covington, Ind.	1.00	1.00	1.00	1.25	1.25	1.25
Barton, Wis.	.....	.70	.80	.....	.80	.....
Chicago, Ill.	.....	1.75@2.25	1.95@2.45	1.75@2.25	.....	.....
Cincinnati, O.	2.05	2.00	2.00	2.00	2.00	2.00
Columbus, Ohio	.70	.70	.70@1.00	.70@ .80	70@ .80	.70
Des Moines, Ia.	1.00	.75	1.65	1.65	1.65	1.65
Earlestead (Flint), Mich.	.60	.70	.....	1.05	.95	.95
Eau Claire, Wis.	.60	.60	1.35	.....	1.10	.....
Elgin, Ill.	.....	.80	1.00	.80	.80	.80
Elkhart Lake, Wis.	.75	.60	1.00	.84	.84	.84
Ft. Dodge, Ia.	1.55	1.40	2.45	.....	.....	2.45
Grand Rapids, Mich.	.60	.60	.....	.90	.85	.85
Greenville, Mechanicsburg, O.	.80	.70	.80	1.00	.85	.80
Humboldt, Ia.	1.00	.85	1.90	1.90	1.90	1.90
Indianapolis, Ind.	.60	.60	.....	1.50	.75	.75
Janesville, Wis.	.....	.65	.....	.....	.75	.....
Mason City, Ia.	1.00	.90	2.00	1.85	1.85	1.75
Milwaukee, Wis.	1.50	1.50	1.60	1.60	1.60	1.60
Minneapolis, Minn.	.50	.50	2.00	1.75	1.50	1.50
Moline, Ill.	1.00	1.00	1.60	1.50	1.40	1.30
Oxford, Mich.	.....	.....	.....	.....	.....	1.25
Pittsburgh, Pa.	.....	1.30	1.30	.....	1.00	1.00
Saginaw, Mich., f. o. b. cars	1.30	**1.30**	2.20	1.95	1.85	1.85
St. Louis, Mo., f. o. b. cars	1.65	1.70	1.85	1.65	1.60	1.60
Summit Grove, Clinton, Ind.	1.00	1.00	1.00	1.00	1.00	1.00
Terre Haute, Ind.	1.00	1.00	.....	.....	1.25	1.00
Toledo, Ohio	.75	.75	.....	.....	.....	.....
Yorkville, Moronts, Oregon and Sheridan, Ill.	.70@ .85	.70@ .90	.90	.80@ .90	.80@ .90	.80
SOUTHERN:						
Flomaton, Ala.	.....	.85@1.00	.....	.....	.....	2.00@2.50
Knoxville, Tenn.	1.25	1.25	1.65	1.65	1.65	1.50
Lake Weir, Fla.	.....	.75	.....	.....	.....	.....
Lincoln, Neb.	.90	.90	2.20	2.20	.....	.....
Macon, Ga.	.....	.75@1.00	.....	.....	.....	.....
Memphis, Tenn.	1.40	1.40	1.50	.....	.....	1.50
N. Martinsville, W. Va.	.....	1.40	.....	.....	.....	1.20
New Orleans, La.	.....	1.40*	3.00*	.....	.....	.....
Pelzer, S. C.	.90	.....	.....	.....	.....	.....
Pine Bluff, Ark.	1.25	.95	Concrete gravel, all sizes, 2.00			
Roseland, La.	.....	.35	.....	.....	1.25	.....
Tulsa, Okla.	.....	.70	.....	.....	.....	.....
Waco, Texas	.70@ .80	.70@ .80	.....	.....	.....	1.10
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	.80	.80
Kansas City, Mo.		(Kaw River sand, car lots, .75 per ton, Missouri River, 1.50)				
Niles, Calif.	1.00	1.00	.90@1.10	.85@1.00	.85@1.00	.85@1.00
Pueblo, Colo.	.95	.90	.....	.....	.....	2.00
San Francisco, Calif.	.....	1.00	1.00@1.20	.85@1.00	.85@1.00	.85@1.00
Saratoga, San Jose, Calif.	.....	**.60@ .75**	**.60@ .70**	**.60@ .70**	**.60@ .70**	**.60@ .70**
Vancouver, B. C.	.....	1.30*	.....	1.30*	.....	1.20*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Boonville, N. Y.	.60@ .80	.....	.55@ .75	.....	.....	1.00
Fishers, N. Y.	.85@1.00	.....	.....	.....	**1.00**	.....
Glenville, N. Y.	.....	.....	.....	1.00*	.....	.....
Yardville, N. J.	.....	**.50@ .75**	.....	.....	.....	.....
York, Pa.	.....	1.20@1.30		(crushed rock sand)		
CENTRAL:						
Attica, Covington, Silverwood, Ind., and Palestine, Ill.	.85	.85	.85	.85	.85	.85
Cherokee, Hawarden, Ia.	.....	.80 per ton—1.20 washed				
Des Moines, Ia.	.....	Washed con. mix., 25% gravel, 1.00; 50% gravel, 1.20				
Earlestead, (near Flint, Mich.)	.....	.60 per yd.				
Elkhart Lake, Wis.	.....	.75 per ton (washed concrete material)				
Ft. Jefferson, Mechanicsb'g, O.	.70	.60	.60	.....	.....	.....
Greenbush, Mich.	**.65**	.....	.....	.....	.....	.....
Hersey, Mich.	.....	.....	.70	.70	.70	.....
Janesville, Wis.	.....	.65	.....	.....	.75	.....
Lincoln, Neb.	.....	.....	Sand gravel mix, 1.30			
Oxford, Mich.	.....	.....	.....	.....	.....	.85@ .95
Saginaw, Mich., f. o. b. cars	.....	.75	1.30	1.30	1.30	1.30
St. Louis, Mo., f. o. b. cars	.....	.....	.....	.....	.....	1.75
Summit Grove, Ind.	**.65**	**.65**	**.65**	**.65**	**.65**	**.65**
Toledo, Ohio	.....	.....	.....	.....	.75	.....
Yorkville, Oregon, Moronts and Sheridan, Ill.	.....	.75@ .85	.....	.....	.70	.....
SOUTHERN:						
Albany, Ga.	.70@1.00	.....	.....	.....	.....	.....
Dudley, Ky. (Crushed Sand)	.....	1.15	.....	1.10	.....	.....
Lindsay, Tex.	.....	.....	.50	.50	.50	.....
Valde Rouge, La.	.....	.....	.....	.....	.....	.60@ .75
Waco, Texas	.....	.....	.....	.....	.....	.95
WESTERN:						
Saratoga, San Jose, Calif.	.....	.60@ .75	.60@ .70	.60@ .70	.60@ .70	.60@ .70
Vorkville, Ore.	.....	.40	.....	.....	.40	.....
Seattle, Wash.	1.25	1.25	2.00	1.25	.....	1.25

* Cubic yard. **B** Bank. **L** Lake. || Ballast.

Crushed Slag

City or shipping point	Roofing	¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:							
Bethlehem and Emaus, Pa.	2.50	.90	1.50	1.20	1.20	1.20	1.20
Buffalo, N. Y.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
E. Canaan, Conn.	4.00	1.10	2.50	1.35	1.35	1.25	1.25
Eastern Pennsylvania and Northern New Jersey	2.50	.90	1.50	1.10@1.25	1.10@1.25	1.10@1.25	1.10@1.25
Erie, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Emporium, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Hokendaugua and Donaghmore, Pa.	2.50	.90	1.50	1.20	1.20	1.20	1.20
Lebanon, Pa.	2.50	.85	1.50	.85	.85	.85	.85
Sharpsville and Struthers, Pa.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
Western Pennsylvania	2.50	1.25	1.25	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.	All sizes, $1.50, F. O. B. Chicago						
Detroit, Mich.	All sizes, 1.65, F. O. B. Detroit						
Ensley, Ala.	2.05	1.00	1.10	1.25	1.25	1.00	.95
Ironton, Jackson, O.	2.00	1.35	1.70	1.35	1.35	1.35	1.35
Toledo, O.	2.62	2.12	2.37	2.37	2.37	2.12	2.12
Youngstown, Dover, Hubbard and Leetonia, O.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
SOUTHERN:							
Ensley, Ala.	2.05	1.00	1.25	1.25	1.25	1.00	.95
Longdale, Goshen, Glen Wilton and Low Moor, Va.	2.50	1.00		1.25	1.25	1.15	1.05

Agricultural Lime and Hydrate

	—Agricultural Lime— Bulk	Bags	Per Cent CaO	Per Cent MgO	Agricultural Hydrate Bags
EASTERN:					
Adams, Mass.			98	38	8.00
Bellefonte, Pa.	11.00		95.5	.72	11.50
Berkeley, R. I.			50	18	15.00
Cavetown, Md.	8.50				
Cedar Hollow, Devault, Rambo and Swedeland, Pa.	10.50		45.50	30.50	13.00
Chippewa, Pa.	6.50@7.00		78.67	1.33	
Farnams, Mass.	6.50	8.00	60	2	
Frederick, Md.	7.75		88	5 to 8	10.50
Grove, Md.	8.00				10.75
Highgate Springs, Vt.	6.00		85	2	8.00
Hyndman, Pa	5.00	8.50	80.23	2.87	
Lime Kiln, Md.	9.50	13.50			13.50
Lime Ridge, Pa.	5.25@6.50		80.56-62.56	3.87-1.75	
Mt. Union, Pa.	6.25		93.69		
Newburgh, N. Y.			57	38	8.00
New Castle, Pa.	3.50	4.50	47.6 to 50.4	0.62 to 1.12	
Paxtang and Lemoyne, Pa.	4.00@6.00		60	12	
Rosendale, N. Y.	8.00	9.00	92	5	
Union Bridge, Md.	11.00	5.50	73	1	13.00
Williamsport, Pa.	6.25	11.00	84-87	2-3	11.00
West Rutland, Vt.	5.50	8.00	68	3	
West Stockbridge, Mass.	3.35	5.35			12.00
York, Pa.	10.50		96.31	2.73	13.00
CENTRAL:					
Alton, Ill.	12.00		97.0		
Delaware, O.			50.0	12	13.50
Knowles and Valders, Wis.	4.00	9.00	55	45	13.00
Manistique, Mich.	11.00		95	2	11.00
Marblehead, O.					13.00
Mitchell, Ind.					13.50
Sheboygan, Wis.	5.50	8.50	58	40.5	
Woodville, Ohio	10.50		54	45	13.00
SOUTHERN:					
Blowers, Fla.	5.50		98.5		
Burns, Tenn.	10.00		96	0.54	14.00
Chippewa, Fla.	5.00		80 0	15 0	
Claremont, Va.	5.00	7.00	85-95	2-5	
Dittlinger, Texas		9.00@11.00	98.62	0.29	12.50@15.00
Erin, Tenn.	11.00		97.82	0.12	
Knoxville, Tenn.	12.00		98.5	.05	15.00
Lushing, Va.	9.00	11.25	60	15	12.75
Maxwell, Va.	6.50		84		6.50
Newala, Ala.	8.10		99.33		
Ocala, Fla.	4.00	6.00 pulv.	98⅓ (dry basis)		
Staunton, Va.	9.00	11.50	80.00	15.00	
WESTERN:					
Colton, Calif.	15.00		97	2	
Kirtland, N. Mex.	12.00				
San Francisco, Calif.			96	0.33	15.00
Tehachapi, Cal.	6.00	8.00	96	2	

Miscellaneous Sands

(Continued from preceding page)

Bridgeton, N. J.—Core	2.00
Cleveland, O.—Molding coarse	2.00@2.50
Brass molding	2.00@2.50
Molding fine	2.00@2.50
Core	1.25@1.50
Columbus, O.—Core	1.00@3.00
Brass molding	3.50@4.00
Glass sand	3.00
Molding fine and coarse	3.00
Conneaut, O.—Molding fine	2.25@2.50
Molding coarse	2.00@2.25
Delaware, N. J.—Molding fine	2.00
Molding, coarse	1.90
Brass Molding	2.15
Eau Claire, Wis.—Core	.60@ .70
Sand blast, wet	1.75@2.25
Sand blast, dry	3.00@3.50
Traction	.60@ .70
Fleetwood, Pa.—Furnace lining	2.25
Franklin, Pa.—Traction	2.25
Brass molding	2.50
Core	3.00
Molding fine	3.00
Molding coarse	3.00
Sand blast	5.00
Greenville, Ill.—Molding coarse	2.00@2.25
Hancock, Md.—Core and brass mldg.	1.65
Hellam, Pa.—Core	2.00@2.50
Joplin, Mo.—Stone sawing, flint	1.25
Kansas City, Mo.—Missouri River core	.80
Klondike and Gray Summit, Mo.—Molding fine	2.00@3.00
Mapleton, Pa.—Core, furnace lining, molding fine and coarse damp	2.50
Core, furnace lining, moulding, fine and coarse, dry	3.00
Massillon, O.—Molding fine and coarse	3.50
Core	3.50
Glass sand	4.00
Traction	3.50
Furnace lining	4.00
Michigan City, Ind.—Core, bank	.75
Millington, Ill.—Glass sand	2.50@3.00
Core sand	2.00@2.50
Furnace lining	2.50
Roofing sand	2.50
Stone sawing	2.00
Mineral Ridge, O.—Core, molding, sand blast, roofing, etc., washed, screened (damp)	3.00
Montoursville, Pa.—Core and traction	1.50@2.00
Brass molding	1.75@2.25
Glass sand	2.00@2.75
New Lexington, O.—Molding fine	3.50
Molding coarse	3.00
Oregon, Ill.—Core, furnace lining, molding fine, brass molding	2.50
Sand blast, molding coarse	3.50
Ottawa, Ill.—Crude silica sand	1.25@1.50
Ottawa, Ill.—Core, furnace lining, roofing	2.50
Sand blast	5.00
Glass sand	3.50@4.00
Stone sawing	2.00
Ridgeway, Pa.—Glass sand, green	2.25
Glass sand, wash	2.50
Molding, fine and coarse	1.20
St. Peter, Minn.—Glass sand	2.25
Core sand	2.25
Brass molding	2.25
Molding fine	2.25
Rockwood, Mich.—Molding, roofing, stone sawing	3.00@4.00
Sand blast	3.50@4.00
Thayer, Pa.—Traction	2.25
Furnace lining	1.40
Molding fine and coarse	1.50
Core, steel	2.25@2.50
Tygarty, Ky.—Core and stone sawing	2.60
Fire-brick sand, washed but not dried	2.15@2.40
Utica, Pa.—Core	3.00
Molding fine	3.00
Molding coarse, traction	3.00
Brass molding	3.00
Warwick, Ohio—Core, furnace lining, molding fine and coarse (dry)	3.00
Same, green	2.50
Wedron, Ill.—Core (crude silica)	1.25
Molding fine, coarse	1.25
Furnace lining	1.50
West Albany, N. Y.—Molding fine	2.50
Molding coarse	2.50
Brass molding	2.50
Zanesville, Ohio—Molding fine and brass	2.50@3.00

Crushed Gypsum

Castalia, O.—Crushed, to cement mills	4.00
Ft. Dodge, Ia.—Bulk	3.50
Grand Rapids, Mich.—Crushed gypsum rock	4.50
Gypsumville, Man., Can.—Crushed	3.50
Oakfield, N. Y.	4.00
Gypsum, O., and Akron, N. Y.	4.50@5.50

(Gypsum) Land Plaster

Castalia, O.—Land plaster	6.00
Bags extra—Jute, 3.00; ppr., 1.00.	
Garhutt, N. Y.—Land plaster, bags	8.00
Grand Rapids, Mich.—Ground gypsum rock	8.50
Mound House, Nev.—Ground gypsum rock	7.50@8.00
Sacks, .25 extra	
Oakfield, N. Y.—Ground Gypsum rock	8.00
Plasterco, Tex.	12.00
Sandusky, O.	6.00
Jute, 3.00 extra; ppr., 1.00 extra.	

Ground Rock Phosphate

Centerville, Tenn.—B. P. L., 70%; ton, 2000 lbs. (90% thru 100 mesh)	9.00@10.00
Lump rock, 72% to 75%, B. P. L.	6.00@8.50
Centerville, Tenn.—B. P. L., 65%	8.25
B. P. L., 70%	9.00@10.00
Brown rock, 75% and better	12.00
Gordonsburg, Tenn.—2000 lbs. (90% thru 100 mesh)—B. P. L., 60%	6.00
B. P. L., 65%	7.00
B. P. L., 70%	9.50
B. P. L., 75%	12.00
Lump rock, long ton, 70%	9.00
Mt. Pleasant, Tenn.—(B. P. L. 68%) 13% phosphorus	7.50@9.00
14% phosphorus	8.00
Mt. Pleasant, Tenn.—B. P. L., 70%	11.50
Norwills, Fla.—Fla. Hard Rock (B. P. L., 68%)	10.00
Wales, Tenn.—(B. P. L., 70%)	8.75

Florida Soft Phosphate

Croon, Fla.—Ground pebble, 30%	16.00
Pulverized soft, 26%	17.50
Jacksonville (Fla.) District	10.00@12.00
(Add 2.50 for sacks)	
Phoslime, Fla. (in burlap bags)	15.00

General News from Rock Product Markets

Priority Order Again Extended

SERVICE Order No. 15, (applying east of the Mississippi River) issued by the Interstate Commerce Commission on Sept. 16, extends until further notice the provisions of Service Orders Nos. 7 and 9, granting preferential open top car supply to the coal mines. Permission is given, as in the former orders, for the use of open top cars for loading commodities other than coal when moving in the direction of the mines. Also, open top cars less than 38 inches in height are still excluded from the operation of the order and, therefore, such cars may be employed for loading any commodities for shipment to or from the direction of the mines.

By further provision of Service Order No. 15, the railroads are directed to place an embargo against the receipt of any commodity loaded in open top cars suitable for coal lading to any consignee who fails to unload such cars within 24 hours after placement, the embargo to remain effective until all freight thus transported and placed has been unloaded by such consignee.

Service Order No. 17, issued September 17, authorizes the railroads to furnish open top cars to all mines that are able to load within 24 hours, regardless of the method employed in loading. This virtually cancels Service Order No. 14, which denied cars for loading to wagon mines.

Service Order No. 11, giving preference to the movement of coal to tide water for shipment by vessel to New England, has been suspended indefinitely on account of the improved coal situation in that territory.

Congress Expected to Aid Construction Work

THAT THE NEXT SESSION of Congress reasonably may be expected to do all within its power to help the nation meet its construction problem is regarded as a certainty. It is believed that it will look with favor upon appropriations intended for studies to devise means of reducing costs.

One of the ways in which economies can be effected, it is believed, is by increasing efficiency in the mining and the handling of the non-metallic minerals. The construction industries alone will use non-metallic minerals to the value of $400,000,000 in 1920, it is estimated. It is believed that convincing information can be compiled looking to the substitution of mechanical equipment for hand labor and the practice by more operators of the short cuts which have been developed by the more highly organized companies. It is thought that much waste can be eliminated and that ways can be found to utilize unavoidable waste.

It is suggested that centers of production of basic raw materials should be mapped, as well as centers of consumption, so that savings can be made on freight charges and rolling stock can be economized. The governmental agency charged with the work, in addition to disseminating such information as the fact that per-man production oftentimes can be increased seven-fold by substituting steam-shovel loading for hand labor, would undertake, for instance, to establish a nation-wide use of standard screen sizes.

Limestone screenings are valuable for fertilizer purposes. Ways could be devised, it is believed, to utilize all limestone waste. Little research has been done on the mineral pigments. There is said to be much room for improvement in the technology of the calcination of gypsum. A useful brick is made from grinding granite waste and mixing it with lime, but few of this particular type of brick are made in this country.

The foregoing are cited to indicate possibilities of a methodical study of economies in the non-metallic minerals. The list could be extended almost indefinitely, it is declared. The Bureau of Mines has been doing some work along these lines, but its activities have been incidental because of lack of appropriations and have been entirely inadequate to meet the demands of the construction industries.

Empire Silica Co. Expanding

IMMEDIATE EXPENDITURE of several million dollars is to be made by the Empire Silica Co. in the development of silica properties near Whycocomagh, N. S., and in the erection of factories for the manufacture of brick of various kinds, as well as lime and cement products, according to an announcement by Major Burton, of New York, in Sydney, N. S., recently. The brick manufacturies which are planned will give employment when in full operation to at least 1,000 men, said Major Burton, of a Canadian company which is now seeking incorporation. The various silica lime and clay properties which are situated in the district of Sky Mountain near Orangedale, N. S., consists of nearly 60,000 acres containing silica, limestone and fire clay. The property is at present being surveyed and a Sydney engineer is at work completing surveys which are to be handed over to the new Canadian company which will acquire all rights of the Empire Silica Co. The board of directors of the new company will consist of the directors of the Empire Silica Co., with the addition of several Canadian financiers.

Increase in Demand for Cement During August

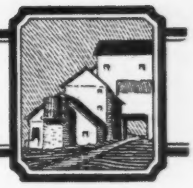
INQUIRIES FOR CEMENT during August were far greater than for any other month in years. Although the box car situation in the Allentown, Pa., cement district is much better, yet the mills are so greatly handicapped by labor conditions that they cannot begin to keep pace with the demand. Their chief trouble is in getting the cement packed and loaded for shipment, though all the mills are working 24 hours a day. A short time ago one large mill had to resort to extreme measures in order to keep their shipments up to schedule. Two officers of the company, the chief chemist and several office men got into overalls, went into the mill and managed to make up a temporary deficiency. Shipments in bulk have helped the situation, but the average dealer finds himself handicapped in accepting bulk shipments, due to shortage of labor and bagging equipment at his warehouse. Most of the mills are shipping as much cement as they ever did, yet the demand far exceeds the supply. In view of this it is safe to predict that there is little likelihood of prices dropping this year. There is also a big demand for cement for export, but the foreign trade is obtaining a very small percentage of their requirements, although large premiums have been offered by the New York exporters.—"Tomkins Brothers."

Southern Road Men Organize

AT a recent meeting in Memphis, Tenn., the Southern Road Material & Contractors' Association was organized. The membership will include for the present owners of gravel pits, road contractors and shippers of sand, gravel and crushed stone, as well as dealers in road material. G. W. Fooshe was elected secretary-manager and other officers will be chosen at the next meeting.

The members have appointed a committee who will go to Washington to take up the question of cars for the shipment of road material for the hard surfaced roads now under construction in west Tennessee, Arkansas and Mississippi, and will oppose the action of the railroads in diverting cars to other sections. The discussions showed that lack of cars has almost brought road construction to a standstill in many communities.

News of the Industry



Incorporations

The **Atlas Sand Co.**, Cleveland, O., has been incorporated for $10,000 by A. F. Counts and Sam Selker, both of Cleveland.

The **Wisconsin Limestone Co.**, Waukesha, Wis., has been incorporated for $40,000 by H. S. Meigh, W. J. Holladay and John D. Bower.

The **Hodgson Sand and Gravel Co.**, Newark N. J., has been incorporated for $300,000. The main office is at 610 Broad St., Newark.

The **Ideal Molding Sand Co.**, Ottawa, Ill., has been incorporated for $1,000 to mine sand by Clarence Griggs, I. Thornton and I. M. Martin, all of Ottawa.

The **Wysaugil Granite Co.**, Thomaston, Maine, has been incorporated for $10,000 by A. E. Saylor, president and treasurer, W. K. Saylor and H. H. Gilchrist.

The **Antioch Limestone Pulverizing Co.**, Antioch, Ohio, has been incorporated for $25,000 by H. M. Hoff, J. R. Ullom, W. G. Stewart, J. E. Dornbusch and G. T. Polen.

The **Beverly Stone and Sand Co.** of Knox County, Tenn., has been incorporated for $25,000 by Chas. M. Seymour, T. G. McConnel, A. L. Mason, B. H. Testerman and E. M. Richards.

The **Great Eastern Gravel Corp.** Buffalo, N. Y., has been incorporated for $1,500,000 to engage in the sand and gravel business. The incorporator is G. A. Keating, 918 Mutual Life Bldg., Buffalo.

The **Island Sand Co.**, Marietta, Ohio, has been chartered with a capital of $50,000 to deal in sand and gravel. The incorporators are R. M. Harley, L. A. Noll, A. B. Fisher, F. N. Harley and H. G. Forshay.

The **Sandstone Quarries Co., Minneapolis, Minn.**, has been incorporated for $100,000 to quarry and manufacture stone for paving, building, etc. The officers are J. A. Smith, pres.; A. J. Wentzel, vice-pres.; William Penn, sec'y-general manager.

John F. Lynch Co., Boston, Mass. has been incorporated for $100,000 to deal in gravel, crushed stone, repair of streets, etc. John F. Lynch, 11 Ricker Pl., Newton, Mass., is president and treasurer; the other members being E. R. Prout and Chas. Innes.

Constant Sand & Gravel Co. Denham Springs, La., has been incorporated with a capital of $125,000 for the purpose of developing the Amite river gravel deposits. New equipment is being installed and a spur track from Baton Rouge to the gravel pit will be put in. It is planned later to erect a glass plant. The officers of the company are: Pres., F. T. Constant; Treas., George Bailey, and general manager, T. T. Harrison.

Sand and Gravel

The **Eau Claire Sand & Gravel Co.**, Eau Claire, Wis., has completed improvements to their plant at a total cost of $300,000. The improvements include a sand drying apparatus.

Mount Pleasant, N. J.—More sand from the numerous pits about here is being shipped than ever before, and even during the war, when the demand was heavy. More cars are available, and the owners are anxious to get off the big orders before the ground freezes. There are a dozen or more of the pits that are being worked as never before.

Columbus, Ohio.—Charging the Mt. Calvery Gravel and Sand Co. with violating its contract with the city by excavating below the street level and not filling in afterwards, the Southwest Advance League has asked the City Council of Columbus to terminate contracts with this company when the present contract expires on January 1, 1921. The matter was referred to the director of service for investigation.

Columbus, O.—About $60,000 will be expended on improvements to be installed by the Southern Sand, Gravel & Supply Co., Columbus, Ohio. A new electrically operated tipple will be erected as well as a plant on the Scioto River on ground recently acquired. The tipple will have a capacity of about 1,000 tons daily. A dredge will be operated in the river. W. H. Loughbridge is president and J. H. Hays, secretary and treasurer of the company.

The D. V. Johnston Co., New Orleans, La., are the largest handlers and producers of sand and gravel in the South. Southern gravel is said to be as good as any obtainable in the country and the company often receives orders from distant points for cargoes of Southern gravel. In addition the concern handles lumber on a large scale. Recent freight congestion had hampered the firm somewhat, but business is again booming. The company is located in the Whitney Building.

Quarries

The Texas Stone Co., Dallas, Tex., against which a petition of bankruptcy was filed on Aug. 18, alleging the company was bankrupt to the extent of $290,460.36, filed an answer to the petition with Louis Maynard, clerk of the Federal District Court. In the answer the company admitted bankruptcy, and that it was a non-profit-making concern. Its assets amount to $275,511.94, the answer states.

Federal Crushed Stone Co., Chico, Tex., has begun the construction of a $1,000,000 quarry and crushing plant. Ernest Thurmond, of Dallas, is president, and Charles Hutchinson, of Dallas, is chief engineer. S. J. Pulliam, who was superintendent of road construction in Dallas county for 16 years, will be in charge of the construction of the plant. As soon as material arrives, a large force will be put to work to construct the dam and buildings for the plant. The right-of-way for the switch has been secured and the survey already completed. The switch will leave the Rock Island road north of the Morris Spur, and will run west and south one mile to the plant.

The Belknap Limestone Co., Belknap, Ill., has been organized with the following officers: G. B. Dodds, Pres.; Gus Beaman, Vice-Pres.; Chas. Marshall, Sec'y-Treas. The company is incorporating for $50,000 and the stock has all been subscribed. Their object is to install a limestone plant for the manufacture of agricultural limestone also if necessary to crush stone for the building of hard roads. This stone has been thoroughly tested for both agricultural and road purposes. It tests very high in calcium carbonate which makes it valuable as agricultural stone, also the physical analysis shows it to be hard enough for good road stone. Since there are no agricultural plants in southern Illinois, and since the increase in freight rates make the use of limestone from the northern plants prohibitive, this plant will be of increasing value to the farmers of this section of the state.

The Gouverneur Limestone Co., Gouverneur, N. Y., has just completed the construction of a new trestle, leading from the quarry pit to the railroad siding equipped with a skip which loads at the quarry and dumps directly into the cars for shipment. The material handled in this manner consists mainly of what is known as one man stone which is shipped for use in the paper mill industry. Another improvement consists in the replacement of the old hoist with a new and larger hoist manufactured by the Lidgewood Manufacturing Co. of New York. The mill is also now undergoing extensive repairs in preparation for the opening of the limestone grinding season, the supply for the 1921 season being ground during the winter months. The storage capacity of the mill was recently nearly doubled and it is expected that the ground limestone department will be ready to resume operations by the first of October.

Cement

New Orleans, La.—Building material valued at approximately $100,000 was destroyed by fire here today which leveled the Carolina Portland Cement Company's warehouse.

Ontario, Can.—Ontario cement plants are closing down on account of fuel scarcity. It is stated that only one company is turning out cement in the province at the present time.

Robert McCreath & Co., Harrisburg, Pa., have been awarded the contract by S. W. Shoemaker & Son, to furnish the cement for the first of the wing buildings to be added to the Capitol, it has been learned. The contract will involve something like $10,000 barrels of Atlas cement.

Ernest Smith & Co., 20 Broad St., N. Y., offer subject to prior sale, 200 shares of Alsen Cement Pfd. at 81, and 50 Alsen Cement com. at 110.

Inland Portland Cement Co., Spokane, Wash., is rushing work on the building of its new flume from Sullivan Lake to the power plant at Metaline Falls. The work will require about 4 months' time and during that period the cement plant will be forced to close down and the town will be without electric lights. Demand for cement is so great that the company's stock is rapidly depleted.

Walla Walla, Wash.—There may be a suspension of sidewalk work in this city and a delay in the completion of highway paving jobs unless the threatened shortage of cement is relieved. For several weeks the highway contractors have been borrowing from each other in an effort to keep all contracts moving, but unless a large number of carloads arrive very soon there will have to be extensive shutting down of work.

The Acme Cement Co., Catskill, N. Y., has chartered four large boats for use in shipping its cement products from Catskill Creek to delivery points. During the past summer the Acme has made several shipments from Catskill Creek to Boston, and it is understood the chartered boats will be used for this purpose, its trade in that direction being an increasing one. The chartered boats include one large freight steamer and four capacious barges.

The Penn-Allen Cement Co., Philadelphia, Pa., with headquarters at Allentown, Pa., has acquired a controlling interest in the Industrial Limestone Co., Bethlehem, Pa., and in the future will direct the operations of this organization. The company has a large limestone quarry at Steubens, near Bath, Pa., and the output of this plant will be utilized by the new owner at its cement works. The plant also contains five modern lime kilns, used for the manufacture of hydrated lime. Offices of the Industrial company will be removed to Allentown. W. E. Erdell has been elected president, and E. A. Wolfe, vice-president.

Alsen, N. Y.—A large steel tower which was used in lifting and carrying concrete in the construction of the concrete barges for the government at the Harrison shipyards in Athens, has been taken down, and is being erected at the Alsen Cement Works. It will be used to move and deposit cement from the mixers in connection with the erection of the new concrete packing house and other buildings at the Alsen works. The tower weighs nearly 50 tons and had to be moved in sections. Other new improvements include a concrete emergency hospital, 12 by 16 in size; a building 18 by 36 containing shower baths, toilets, lockers, etc., for the employes, to be of concrete construction with the best sanitary plumbing; also an automatic conveyance elevator, for carrying the clinker from the clinker building to the mill which will be 130 ft. long by 12 ft. wide and 45 ft. high, also a new concrete wall and clinker pit, which in its construction will require 300 cubic yards of concrete and will be lined with brick.

Dalen, Norway—The manufacture of potash was begun last month, according to consular reports at Dalen, near Brevik, Norway, by the proprietors of the Dalen Portland cement factory. The latter, which was established in 1916, is capitalized at the equivalent of $857,600. The new potash factory was originally planned as a means to dispose of the dust created in the process of making cement. It is built in close proximity to the main smokestack of the cement factory. Potash-holding particles contained in the cement dust are carried out with the smoke and caught and separated. A trapdoor arrangement forces the smoke into the potash factory, where it is conducted by means of a tube into the upper story of the factory. The smoke is then forced into a series of smaller tubes, in which it is subjected to an electric current of about 70,000 volts, the result being that the particles of dust are attracted to the side of the tubes or the electric wires placed in the tubes. At certain intervals the tubes are pounded so that the accumulations of dust descend into large bins, from where the dust is sacked, ready to be placed on the market immediately. It is said that the output of the factory will be about 30 tons per day, and in time will be able to cover a large part of Norway's potash requirements.

The Carney's Cement Co., Mankato, Minn., have retained Richard K. Meade & Co., consulting chemical and industrial engineers, 11 E. Fayette Street, Baltimore, Md., to prepare plans and specifications for a new cement plant for them. The new plant will have a capacity of 1,500 barrels of Carney's cement per day and will be located at the old Wydell Quarry about three miles outside of Mankato. The new plant will have eight vertical kilns and will be of steel and fireproof construction throughout. All of the machinery will be driven by individual motors. The equipment includes a large stockhouse with a capacity of 40,000 barrels per day and ample trackage facilities so that shipments may be promptly made. Carney's cement is being extensively used for laying tile and brick and the present plant of 2,400 barrels capacity cannot begin to take care of the increased business of this company. The new mill will be built during the winter and the company will have the increased output on the market in the spring.

Manufacturers

The R. H. Beaumont Co., of 319 Arch St., Philadelphia, contractors for conveying and hoisting systems and complete power plants, have recently opened a Pittsburgh, Pa., office at 230 Fifth Avenue. Thomas Widdop is in charge.

Dwight P. Robinson & Company, Inc. (with which Westinghouse, Church, Kerr & Co., Inc., has recently consolidated), engineers and constructors of New York, has established a new branch office in Youngstown, Ohio, in the Home Savings & Loan Building, in charge of C. I. Crippen. The company recently moved its Cleveland office from the Leader News Building to the Citizens Building, and H. P. Clawson, who was for several years a member of the Chicago staff, has been transferred to Cleveland to take charge of this office. The company now maintains branch offices in Pittsburgh, Youngstown, Cleveland, Chicago, Dallas and Los Angeles, and Sao Paulo, Brazil.

The Pennsylvania Pump & Compressor Co., Easton, Pa., announces the opening of additional sales offices in the following cities: Buffalo, 788 Potomac Avenue, J. B. Laird Manager; Cleveland, 232 St. Clair Avenue, N. E., L. J. Wakefield; St. Louis, 1956 North Broadway, Corby Supply Co.; Minneapolis, 423 Fifth Street, South, L. E. Pollard Co.; Omaha, 804 First National Bank Building, L. E. Pollard Co.

The Link-Belt Co., Chicago, Ill., is now ready to distribute its 32-page book No. 345 entitled "Link-Belt Silent Chain Drives for Cement Mill Equipment." Page 9 gives reasons why this drive is ideal for operating ball mills, tube mills, kominuters, conveyors, elevators, line shafts, quarry-hoists, kilns, dryers, and bag filling machines. These reasons are substantiated by succeeding pages which show many drives in actual operation. Managers, engineers, superintendents and other officials of cement mills will find it to be a very interesting and valuable book. Copies will gladly be sent on application to the executive offices of the Link-Belt Company, 910 S. Michigan Ave., Chicago, or any of its branch offices.

Link-Belt Roller Chain.—The use of Link-Belt Roller Chain as a means of power transmission has been growing so rapidly that the Link-Belt Co. has for some time back felt it would be desirable to publish an engineering data book on the subject. Their new 78-page book No. 257 shows photographs of roller chain drives operating motor trucks, tractors, cotton gins, industrial locomotives and other equipment, but is more than an ordinary catalog. It is a hand book of exceptional value to every power transmission engineer and contains tables from which almost anyone can select the proper size of chain and sprocket wheels to result in the best driving arrangement. Space does not permit a discussion of the other tables and engineering data but anyone having occasion to design, locate, or figure drives will be sent a free copy of this book upon application to the executive offices of the Link-Belt Company, 910 S. Michigan Avenue, Chicago, or any of its branches.

Weltlanfers, Ltd., Toronto, manufacturers of concrete machinery have obtained a Dominion charter with a capital of $800,000 to take over the business of Wetlanfer Bros., Ltd., Toronto, and Thomas Watson, Woodstock.

Retail Dealers

The Quincy Cement, Block & Coal Co., Cleveland, O., has been incorporated for $50,000 by John Takas and Stephan Spisak.

Tracy and Jones, Hornell, N. Y., have been organized with a capital of $60,000 to engage in the supply business. H. E. and W. A. Tracy and H. L. Jones head the company.

The Brookville, Material Co., Brookville, Ind., has filed articles of incorporation with the secretary of state. They have a capital of $10,000 and the directors are J. C. Morin, B. C. Morin and J. P. Goodwin.

P. Paul Plevask Co., Boston, Mass., has been incorporated for $25,000 to engage in the building supply business. The officers are J. P. Skudris, president; P. Paul Plevask, treasurer, and J. P. Jienishevsky.

The Suburb Supply Co., Reading, O., has been incorporated for $60,000 and will deal in building supplies of all kinds. M. G. Roth, Joseph Brenner, John Singer, A. J. Bothe and J. R. Qwane are the incorporators.

The Wisconsin Building Material & Fuel Merchants Ass'n. announces the removal of the offices from Oshkosh to Milwaukee, Wis., due to the extension of its activities to a state-wide basis. The new offices will be located at 33 Merchants & Manufacturers Bank Bldg., 214-220 West Water St.

CLASSIFIED ADVERTISING

Rates for advertising in the Classified Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion.

Plants for Sale

FOR SALE

257 acres of land, underlaid with fine quality limestone suitable for high-grade hydrated lime, agricultural limestone, flux, etc. Water running through property. Located near Warwick, New York. Close to railroad.

Fuller-Lehigh Company
Fullerton, Pa.

FOR SALE

Sand quarry and plant for sale.
400-ton daily capacity.
Slack cable plant. 50 acres of sand.
On D. L. & W. R. R., Hackettstown, N.J.

D. W. GALLAGHER
16 McKeen St. Phillipsburg, N. J.

FOR SALE

90 acres of land, underlaid with 35-foot vein unexcelled concrete gravel and building sand. 80 miles from Chicago; 3 miles from city of 12,000. Water and railroad running through land. Sand and gravel underlaid with 6-foot vein of fine quality fire clay.

Address Box 6, Dayton, Ill.

Plants for Sale

Crushing Plant for Sale

Champion No. 5-B, 13x26-in. Jaw Crusher; capacity 25 to 35 tons per hour with Farquahar 35-H.P. Boiler and Engine; an excellent steamer; 35-ft. Elevator, 12-ft. length, 3-ft. diameter screen, opening ¾ in. to 3½ in., with belts, pulley, shafting, etc. Complete for installation.

This is an A No. 1 plant, in good running order, and has years of good hard service in it.

Low cash price for quick buyer.

Immediate delivery at Marklesburg, Huntingdon County, Pa.

IRVING S. HORTON & CO.
Huntingdon, Pa.

Help Wanted

WANTED

Master mechanic for Lime and Stone operation. Must be able to keep all machinery, steam shovels, locomotives, crushers, etc., in good running order and be proficient in using acetylene welding outfit. State age and experience and give references. Address

Box 1436 Care Rock Products

WANTED

Competent Superintendent for small stone crushing plant who is familiar with the burning of lime and building of kilns for southern Alabama. Good position for the right man; one who can qualify. State salary and experience. Address

Box 1438 Care Rock Products

SUPERINTENDENT WANTED

A quarry, near Philadelphia, producing Silica Sand from rock, desires competent man to take entire charge of production of new plant. Must be experienced in handling crushing machinery, explosives, men, and able to supervise shipments. One experienced in producing Silica Sand for manufacturing purposes preferred. The right man can have splendid opportunity for advancement. State salary expected. References required. Address **Box 1437, Care of Rock Products.**

WANTED

Engineer capable of handling small Ingersoll Rock Chanelling machine. Wire

Siems, Helmers & Schaffner,
514 Guardian Life Bldg. St. Paul, Minnesota

Situations Wanted

Position Wanted

Superintendent desires engagement. Thoroughly familiar with all details of crushing or sand plants, steam shovel operations and where heavy tonnage is desired. Have good organization of efficient labor available. A 1 references. Address

Box 1430 Care Rock Products

POSITION WANTED

By Agricultural Lime Sales Engineer with six years of practical experience in successfully advertising, selling, and marketing agricultural lime and also crushed stone. Can furnish A1 references. Address

Box No. 1435 Rock Products

USED EQUIPMENT

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion.

Repaired Contractors' Equipment

Steam Shovels

Model 60 Marion Shovels, 2½-yard dippers, Nos. 1999, 2059, 2130

1—Model 1 Thew, on railroad trucks, ⅞-yard dipper.

1—Bucyrus Model 70-C, Shop No. 1219.

We have a large stock of thoroughly repaired Construction Equipment of all kinds ready for immediate shipment.

Locomotives

8—18-ton, 10x16" Porter Dinkeys, 36" gauge.
2—12-ton, 9x14" Porter Dinkeys, 36" gauge.
1—17x24", 55-ton, 4-6-0, standard gauge.
3—25-ton Forney type.

Clam Shell Buckets

1—1¼-yard Williams Hercules Bucket.

Cars

30—Western Air Dump 12-yard, standard gauge.
40—Western 4-yard, 36" gauge, steel beam.

H. KLEINHANS COMPANY
Union Arcade **Pittsburgh, Pa.**

FOR SALE

2 13-ton Standard Gauge Whitcomb gasoline locomotives. Also have two steam driven air compressors, 365-ft. and 900-ft. capacity. Would like to exchange for electric driven compressor, of about 400-ft. capacity, driven by 440 volt motor.

The Casparis Stone Co.
Columbus, O.

FOR SALE

2—No. 18 Gates K Gyratory Crushers with elevators and screen; complete; first class; immediate delivery. Also twenty other sizes.

J. F. DONAHOO CO.
Birmingham, Ala.

Shovels, Locomotives, Cars and Cranes

Bucyrus, 40-ton, 1½ yard.
Bucyrus, 70-ton, 2½ yard.
Osgood Model 18, Traction, ¾ yard.
Marion Model 28, Traction, ⅞ yard.
Thew Model 0, Traction, ¾ yard.

LOCOMOTIVES
American, 30-ton Std. Gauge Saddle Tank.
Baldwin, 35-ton Std. Gauge Saddle Tank.

CARS
10 Western 12-yd. Std. Gauge.
48 Kopple 1½-yd. 24 Gauge, Illinois Delivery.

LOCOMOTIVE CRANES
Osgood Model 29, Std. Gauge.

Clam Shell, Orange Peel, and Drag Line Buckets
Blaw Knox, one and two yds. Cap. Clam Shells.
Owen, 1¾ yds. Cap. Clam Shells.
Williams, 2 yds. Cap. Clam Shells.
Smith, ¾ yd. Cap. Orange Peel.
Hayward, 1 yd. Cap. Drag Line.
Page, 1 yd. Cap. Drag Line.
Some of the above items are new.

A. J. O'NEILL CO.
Weightman Bldg. Philadelphia, Pa.

Machinery For Sale

DRYERS—Direct-heat rotary dryers, 3x25 ft., 3½x25 ft., 4x30 ft., 5x35 ft., 5½x50 ft., 6x50 ft., and 7x60 ft.; double shell dryers, 4x20 ft., 5x30 ft., and 6x35 ft.; steam-heated air rotary dryers, 4x30 ft., and 6x30 ft.

KILNS—Rotary kilns 8x60 ft., 6x60 ft., 3½x25 ft., and 3x25 ft.

MILLS—24-in., 22-in., and 16-in., Schutz-O'Neill mills; 8x8-ft., 6x5-ft., 2½x3-ft., 3x3½-ft. pebble mills; 6x6-ft., 5x4-ft., 4½x3½-ft., 2½x2¾-ft. ball mills; 3-ft. Marcy mill; 42-in., 33-in. and 24-in. Fuller-Lehigh mills; 4½x20-ft., 5x11-ft., 5x22-ft. and 6x20-ft. tube mills; 7½x13-in., 9x15-in., 13x24-in., 16x10-in., 20x6-in. and 30x60-in. jaw crushers; one "Infant" No. 00, No. 0, No. 2, No. 3 and No. 9 Williams' swing hammer mills; one Kent type "G" mill; one Aero pulverizer, type "D"; 24-in., 36-in. and 40-in. cage mills; 3-ft. and 4½-ft. Hardinge mills; 18x12-in., 20x12-in. and 30x10-in. roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one No. 2 Sturtevant ring roll crusher; 3-roll and No. 0000 Raymond mills; one No. 5 Telesmith breaker; one 36-in. Sturtevant emery mill; four Giant Griffin mills; one Junior Griffin mill; one 51x14-in. chaser mill.

SPECIALS—Emerick 8-ft. separator; one McDougal and one Wedge mechanical furnaces; five automatic package weighing machines; electric arc furnaces; jigs; one Keystone excavator; 6x8-ft., 6x5-ft. and 4x3-ft. Newaygo vibrating screens.

Air compressors and tanks.

All this equipment is complete and in good condition.

W. P. HEINEKEN, Engineer,
95 Liberty Street, New York. Tel. Cortl. 1841

USED EQUIPMENT

EQUIPMENT

STEAM SHOVELS

2—⅝ yd. Thew "O" Traction. Mass. boiler.
1—No. 3 Thew 1 yd. dipper, R. R. type.

LOCOMOTIVES

2— 3 ton Std. gage Plymouth gasoline.
6—14 ton 36 in. gage Vulcan saddle tanks.
2—14 ton 36 in. gage Porter saddle tanks.
2—18 ton 36 in. gage Davenport saddle tanks.
1—21 ton 36 in. gage American saddle tank.
1—30 ton Std. gage Pittsburgh O-4-O saddle tank.

DUMP CARS

6—24 in. gage 1½ yd. Western 2 way.
35—24 in. gage 1 yd. Koppel 1 way.
8—30 in. gage 1½ yd. all steel quarry, end dump.
6—36 in. gage Koppel 3 yd. V shape, 2 way.
15—36 in. gage 4 yd. Western 2 way.
12—36 in. gage 4 yd. Continental 2 way.

ZELNICKER in ST. LOUIS

Get our New Big Bulletin 285 for unusual Bargains in Railway, Power Plant and Contractors' Equipment, Dump Cars, Track Accessories, Tanks, Pipe, etc.

What have you for sale?

FOR SALE

One 75-H.P. Double Cylinder Morris Engine, D. C. to 8-inch Pump with extra new runner.
One 50-H.P. Horizontal Engine.
Three smaller Engines.
One 80-H.P. vertical Boiler, complete with Grates and Stack.
350 ft. 8-inch Pipe; Suction Hose, Discharge Sleeves, Elbows, and Flanges.
12-inch and 10-inch Rubber Belting.
250 ft. 2-inch Roebling Steel Cable.
1200 ft. 1⅛-inch Roebling Galvanized Cable.
One large revolving screen.

Prices on application to

Succasunna Sand Co., Morristown, N. J.

LOCOMOTIVES

2—50-ton 18x24-in. six-wheel switchers.
3—24-ton 12x18-in. six driver 36-in. gauge. Porters (new) with tenders.
2—18-ton and 14-ton 36-in. gauge Vulcans.
2—10-ton 7x12-in. 36-in. gauge Vulcans.
1—10-ton 36-in. gauge Shay geared.

MISCELLANEOUS

1—Marion 76 steam shovel, No. 3503.
1—Bucyrus dragline, 100-ft. boom, 3½-yd. bucket.
100—60,000-lb. capacity box cars, 40-ft. long.
20—6-yd. dump cars, 4-ft. 8½-in. gauge.
12—1½-yd. "V" steel dump cars, 36-in. gauge.
1—Western standard gauge spreader.
1½-yd. clamshell bucket, 10-hp. and 45-hp. upright boilers, 2-in., 4-in. and 6-in. simple, duplex and centrifugal pumps, tripod drills, etc.
Railway equipment, etc.

INDUSTRIAL EQUIPMENT CO.
McCormick Building Chicago, Ill.

FOR SALE

American Adjustable Hammer Mill, in excellent condition, as good as new. Can be bought at very low cash price. Address

Box 1434 Care Rock Products

For Sale Trucks

2—Knox Tractors Model No. 35, 40 H.P. 4 cyl. motor, 8 cy. end dump.
2—Knox Tractors No. 35, 40 H.P. 4 cyl. 12 cy. side dump.
2—Knox Tractors Model No. 36, 40 H.P. 4 cyl. 3 cy. side dump.
4—10 cy. gravity side dump 4-wheel Lee Trailers.

Dunbar & Sullivan Dredging Co.
2212 Dime Bank Bldg., Detroit, Mich.

WANTED

Pumping outfit to handle 500 to 800 gals. per minute against hundred foot head direct or belt connected to electric motor, oil engine, or steam outfit.

Also in market for 6-in. or 8-in. spiral riveted pipe up to 1000 feet.

Give complete description, price and delivery.

Ruhm Phosphate Mining Co.
Mt. Pleasant, Tennessee

WANTED

1—30-in. Belt Conveyor, 247 ft. long, center to center pulley.
1—30-in. Belt Conveyor, 350 ft. long, center to center pulley.
1—24-in. Belt Conveyor, 350 ft long, center to center pulley.
1—30-in. Belt Conveyor Tripper with or without Belts.
Troughing rolls for each belt, 5 ft. centers.
Return rolls for each belt, 10 ft. centers including drive gearing for each belt.
Give full description including ply of belting.

NATIONAL CEMENT CO.
RAGLAND, ALA.

For 48 pages of unusually good bargains in

CRUSHERS

Compressors, Boilers, Hoists, Rails, Cars, Locomotives, Quarry Equipment, etc.
Write for our Latest Big Bulletin.

ZELNICKER in ST. LOUIS

FOR SALE

2—1-yd. Western Dump Wagons.
1—4-bbl. Wooden Tank Wagon.
1—1½-yd. Brosius Clamshell Bucket.
1—No. 61 Ransom Concrete Mixer.
1—3-ton G.E. 28-in. gauge 250-volt Locomotive.
All in good condition.

KEYSTONE STEEL & WIRE CO.
Peoria, Ill.

FOR SALE

Erie Standard Type B, shop No. 694, Traction wheels. Worked less than 6 months. Good as new. Price $7,000.00, F. O. B. cars, East Peru, Ia.

Peru Stone & Cement Co.
305 5th St., Des Moines, Iowa

IMMEDIATE DELIVERY

2—150 H.P. 125 lbs. HRT. Boilers, Butt strap.
4—No. 6 Gates (Man. Fit.) nickel steel shafts.
1—No. 7½ and 1 No. 8 Gates, Reg. drive.
No. 4 Telsmith plant, AC. motor drive.
Air Compressors (Steam, Belt), 50 to 4000 ft.
40 Boilers, 60-150 HP. 100-130 lbs.
1—30-60 Emerson Brantingham tractor.
1—18-ton Galion loader and bin.
4 NEW No. 4 Gates, Mang. Fit. $2000 each.
10 coils Roebling ⅝-in. traction cable (used).
3 Bag Koehring paver, practically new.
1½-yd. Nagley Slack lined bucket equip.
900 ft. 1¾-in. NEW Roebling steel cable.
Type "O" ¾-yd. Thew steam shovel.
50—25-20-15 and 125 Kw. eng. and turbo sets.
1—42"x16" Traylor Roll Crusher.
2—156 Kva. 240 v. 60 cy. 3 ph. eng. sets.
Send us your inquiries. Pumps, steam and elec. equip., etc.

ROSS POWER EQUIP. CO.
INDIANAPOLIS, IND.

For Sale Crusher

1 new 7x10-in. TRAYLOR Type A Jaw Crusher Complete.

This crusher new and never used. Cheap for quick sale.

A. F. WENDLING CO.
CONTRACTORS
Massillon, Ohio

Do You Care to Save?
Try Us for Good Used

Crushers
Cranes — Cars
Locomotives — Rail
and all kinds of
Quarry Equipment

Reading Engineering Co., Inc.
154 Nassau St. New York

FOR SALE

Complete Ground Limestone Crushing Plant with Sturtevant Mill, Screens, Conveyors, etc.

EMPIRE LIMESTONE CO.
BUFFALO, N. Y.

New—RAILS—Relaying

All sections on hand for quick shipment. Reasonable prices quoted. Our stock is very complete.

M. K. FRANK
Frick Building Pittsburgh, Pa.

WANTED

Good second-hand rock screen 60-in. diameter, 18 ft. long. Screen turning on trunnions preferred. Screen to handle rock from 6 inches down.

NATIONAL CEMENT CO.
RAGLAND, ALA.

Pierce J. McAuliffe

Whitehall Bldg., 17 Battery Pl.

Member American Society Mechanical Engineers
Member Society Naval Architects and Marine Engineers

Design Construction Operation

Sand and Gravel Plants
Dredges
Hydraulic Excavating Equipment

Hydraulic dredging equipment of my design now operating has annual capacity of over 25,000,000 cu. yds. Make use of the experience gained by 15 years' intensive study of problems of pumping solids before deciding upon the equipment for your new plant or the rehabilitation of your present plant.

PRESTON K. YATES

Designer and Construction Engineer

Of Stone Crushing Plants, Conveying and Storage Systems, Quarry Operations, Rotary Lime Kilns, etc.

120 Broadway . . . . New York

James N. Hatch, C. E., M. E.

Member A. S. C. E.

CONSULTING ENGINEER

500 Old Colony Bldg., Chicago

Designs and Constructs

Complete Sand and Gravel Screening and Washing Plants.

Stone Crushing and Storage Plants. Conveying Systems. Contractors' Material Plants

Electric Generating Plants and Transmission Lines.

Estimates and Plans Furnished

F. L. SMIDTH & CO.

50 CHURCH STREET NEW YORK

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CEMENT MANUFACTURING PLANTS
CEMENT MAKING MACHINERY
PULVERIZED COAL INSTALLATIONS
GRANULATING AND PULVERIZING MACHINES FOR ALL MATERIALS
FLINT PEBBLES—SILEX LINING
THE LENIX BELT DRIVE

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ROBERT W. HUNT & CO.

Inspection—Tests—Consultation

Inspection New and Second Hand Machinery, Pumps, Crushers, Steam Shovels, Cars, Locomotives, Rails and Quarry and Contractors' Equipment

INSPECTION AND TESTS OF SAND, GRAVEL, CEMENT, STRUCTURAL STEEL, CASTINGS AND CONSTRUCTION MATERIALS

Cement, Chemical and Physical Testing Laboratories

New York St. Louis CHICAGO Kansas City Cincinnati Pittsburgh San Francisco

The Fuller Engineering Co.

Designing, Constructing and Operating Engineers

Analytical Chemists

Cement and Hydrated Lime Plants a Specialty

Offices: Allentown National Bank Building
ALLENTOWN, PENNSYLVANIA

ANCHOR BRAND COLORS

For Mortar, Cement and Brick—
Brown, Black, Red and Buff
—Strongest and Most Durable

Manufactured by

C. K. Williams & Co.

Correspondence Solicited EASTON, PA., U. S. A.

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for the manufacture of gypsum products, such as wall plaster, moulding plaster, wall board products, gypsum block products, also mixing plants.

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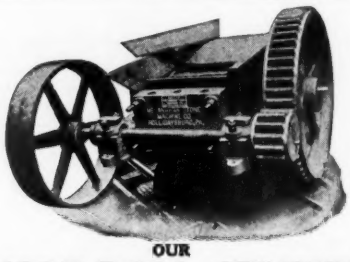

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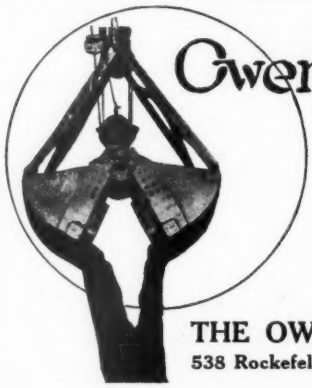

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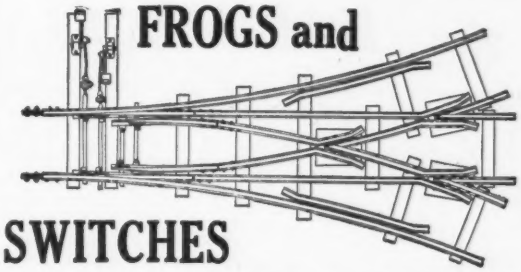

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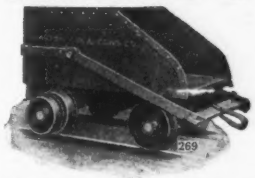

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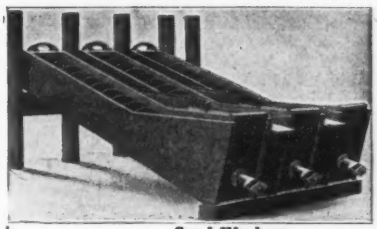

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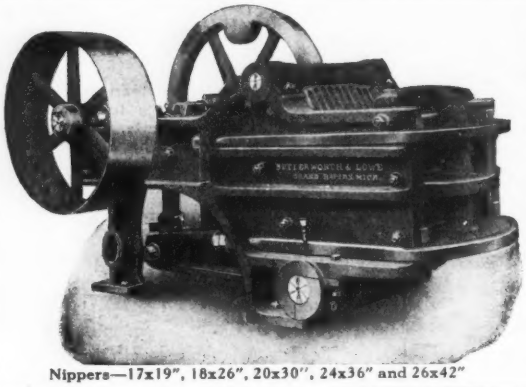

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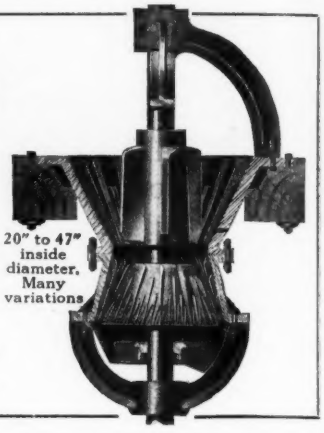

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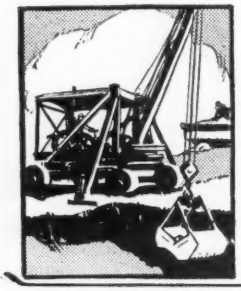

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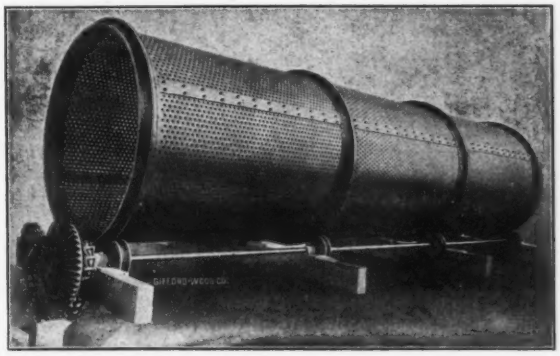

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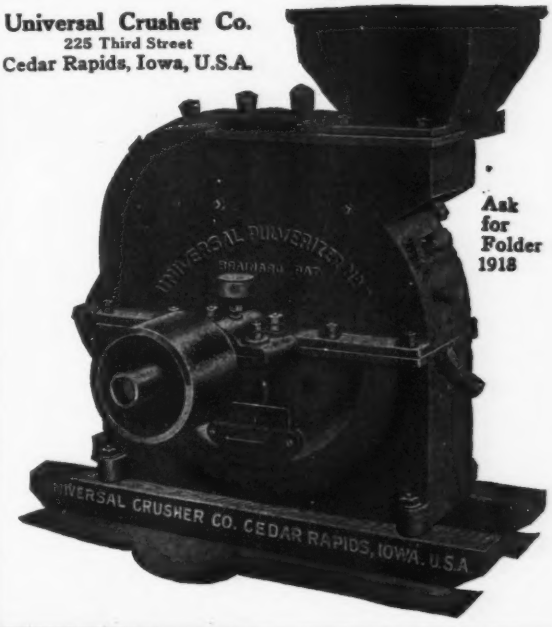

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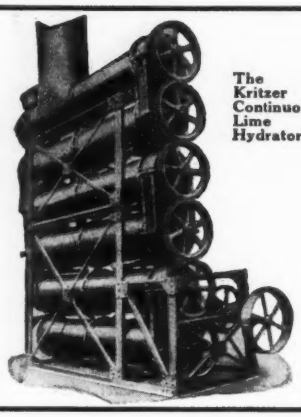

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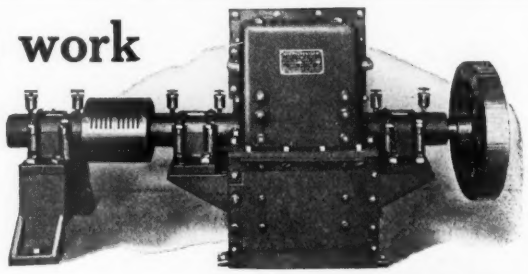

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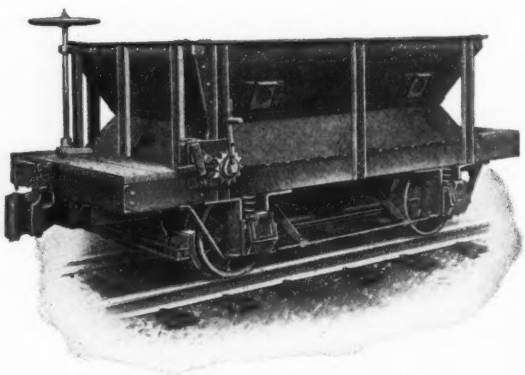

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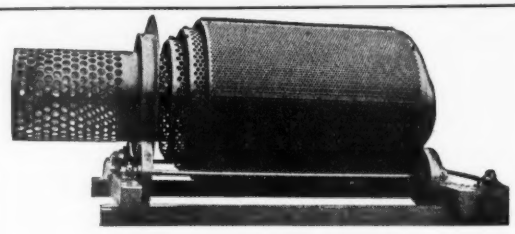

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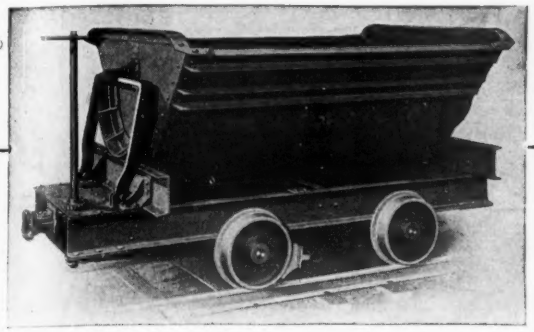

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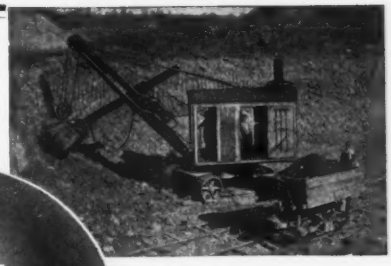

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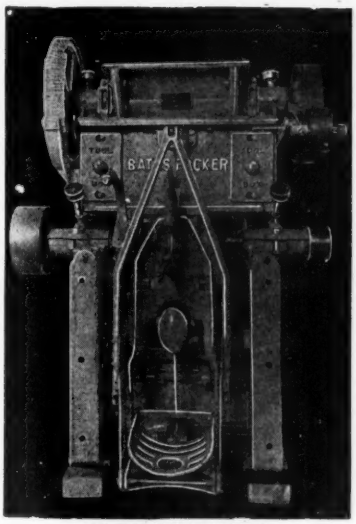

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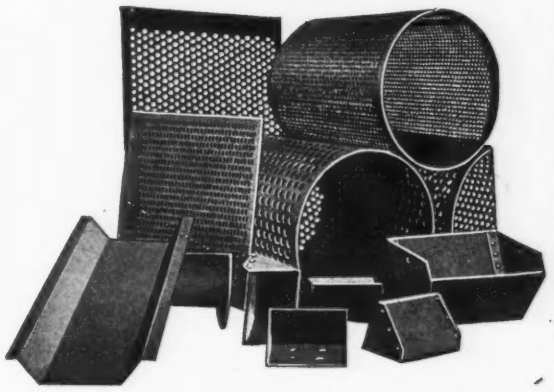

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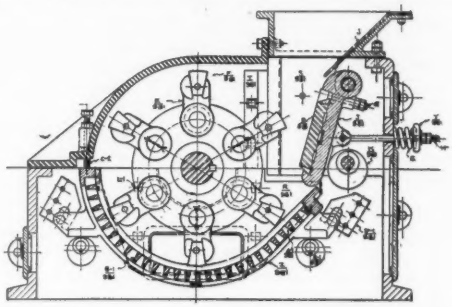

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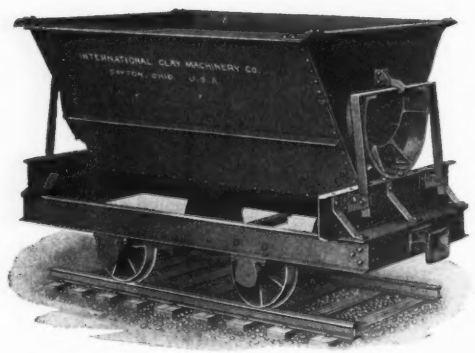

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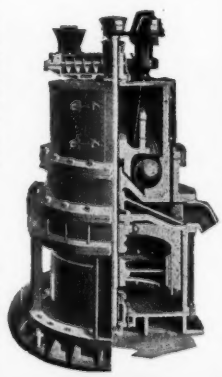

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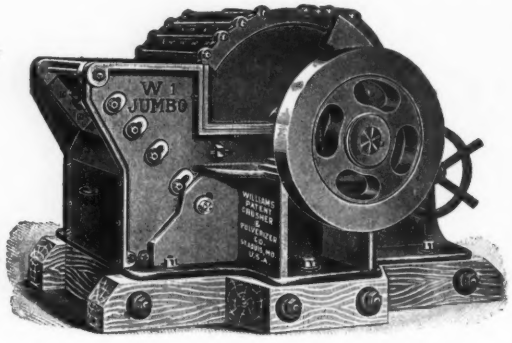

Williams Crushers

Williams Jumbo Crushers are used in quarries as secondary crushers, taking 10-inch and under limestone, as it comes from the primary crushers, and reducing the material to 1½-inch, 1¼-inch or 1-inch and under in one operation. These machines are built in capacities ranging from 30 tons to 300 tons per hour. Many are now in operation. Complete details concerning these crushers are found in bulletin No. 4-B.

WILLIAMS HINGED HAMMER **PATENT CRUSHER AND PULVERIZER COMPANY** ESTABLISHED 1871

PLANT & OFFICES 2701 N. BROADWAY ST. LOUIS, MO.

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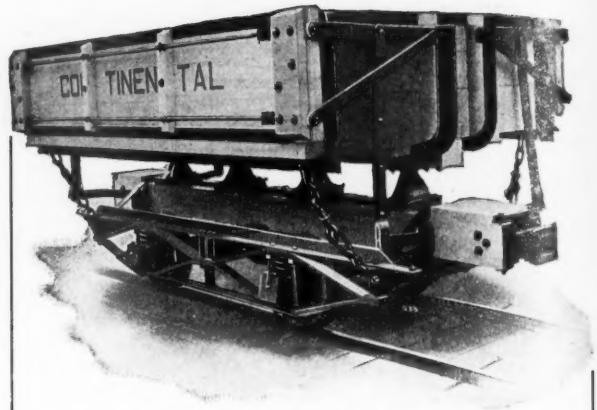

CONTINENTAL DUMP CARS

Are Best for Rock Quarries, Ballast Plants, Sand and Gravel Pits, Etc.

We specialize on dump and quarry cars for all kinds of service, and "Continental" installations are found in the largest and most successful plants.

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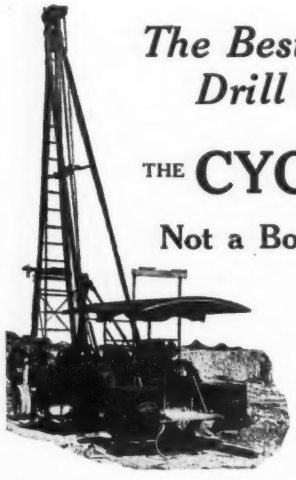
LOUISVILLE, KENTUCKY



The Best Blast-Hole Drill on Earth

THE **CYCLONE** No. 14

Not a Boast—A FACT

We will prove the superiority of the No. 14 Drill by placing one of the outfits in your quarry against any or all other makes.

If the Cyclone doesn't out-drill and out-wear all other drills, we will remove it from the work without cost to you.

Our proposition gets below the paint—it eliminates talking points and evaporates hot air. It puts buying on a strictly engineering basis where it belongs.

Furnished in Steam, Gasoline, Compressed Air or Electric Power Traction or Non-Traction

Let us send you full particulars

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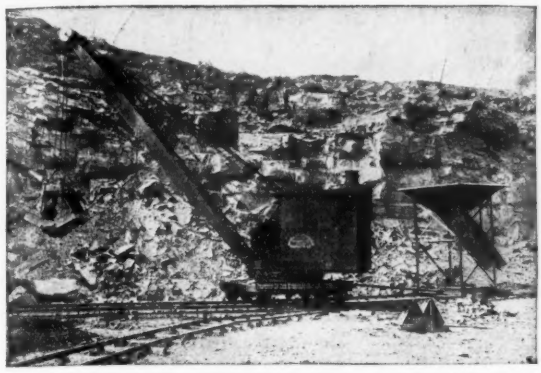
NATIONAL Screen Separator

The Leading Screen in

Efficiency
Durability
Simplicity
Capacity

Write for Descriptive Literature to

NATIONAL ENGINEERING COMPANY
549 West Washington Boulevard, Chicago



O. S. DEPENDABLE Locomotive Cranes

reduce expenses of handling materials, increases profits and output wherever installed. Catalog No. 16 contains valuable information and is mailed upon application.

□□

ORTON & STEINBRENNER CO.
Chicago, Ill.
Factory—Huntington, Ind.

"Perfect" Concrete Brick Power Machine

Also Hand and Power Block Machines

Hand Brick Machines

Well, Cistern and Silo Molds

C. S. WERT—Inventor and Patentee

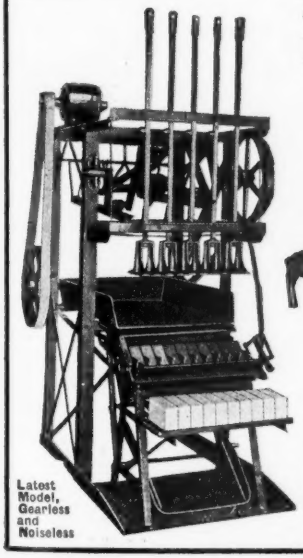
Turns out, with four men, 16,000 to 20,000 concrete bricks in ten hours.

In severe tests, **Perfect** Concrete Brick have proven stronger than common clay and pressed clay brick.

The power tamper may be operated by a one horse power motor, a 2½ horse power gas engine or direct from a line shaft.

"There is no better brick machine manufactured," says W. T. Sharp, of Montana, owner of a **Perfect** brick plant.

Get facts and figures now. Write while the matter is on your mind.



Latest Model, Gearless and Noiseless

Manufactured by
The Wert Mfg. Co.
2547 Railway Exchange Bldg.
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Consider—

There is an all-around constructive superiority about the Morris Pump that enables it to stand the test of real service; and the record of more than 60,000 pumps sold by us during the past 56 years is overwhelming evidence of their efficiency and economy.

When you consider pumps, the record, reliability and reputation of the Morris should be considered.

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Since 1864 Builders of Dredges, Centrifugal Pumps, Steam Engines

MORRIS PUMPS

When writing advertisers please mention ROCK PRODUCTS

Photo Baker

OHIO

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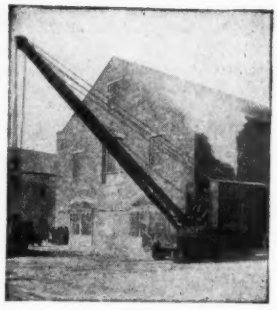
One of these men from
OHIO
Will be your choice for President next November

When you are looking for the right locomotive Crane investigate carefully the design, construction, workmanship and record of the

OHIO

Then make your own comparisons and still another vote will go to

OHIO



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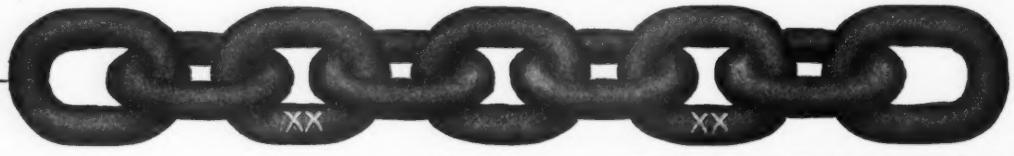
Conveyor, Loading, Steam Shovel, Dredge, Crane, Quarry and Hoisting Chain

UNITED STATES CHAIN & FORGING COMPANY
Union Arcade *"As Good as the Name"* **Pittsburgh, Pa.**



COMPLETE INSTALLATIONS
For Stone Quarries or Lime Plants

We are prepared to build and superintend the installation of all equipment necessary to start operations.

Reliance Products are equal to the best and we know that our engineers can save you money by their recommendations. Prompt deliveries.

Let Us Quote You Prices

Universal Road Machinery Co
Kingston, N. Y.

Reliance Quarry and Road Building Equipment

The Traylor "Bulldog"

A Jaw Crusher with 80% Less Friction

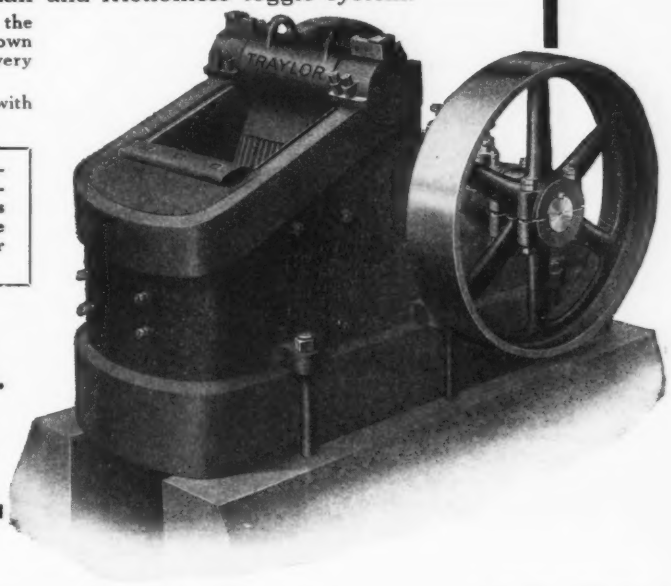
This remarkable economy is effected by improvements found only in the "Bulldogs"—the lighter but far stronger pitman and frictionless toggle system.

In place of a heavy and unreliable steel casting, the "Bulldog" pitman has two wrought steel rods of known strength that means absolute dependability, with the very minimum of weight.

The "Bulldog" Toggle System is self-aligning, and with toggle ends that roll on flat steel, it is **frictionless.**

We announce the conversion of our immense shipyard at Cornwells, Pa., into a plant for the manufacture of Motor Trucks and All Purpose Tractors of a quality equal to the best and which average up with the other older and world known Traylor products.

There are other "Bulldog" features worth knowing. Send for Bulletin RJX-1 TODAY!



Traylor Engineering & Mfg. Co.
Allentown, Pa.

New York, 30 Church St. — Chicago, 1414 Fisher Bldg.
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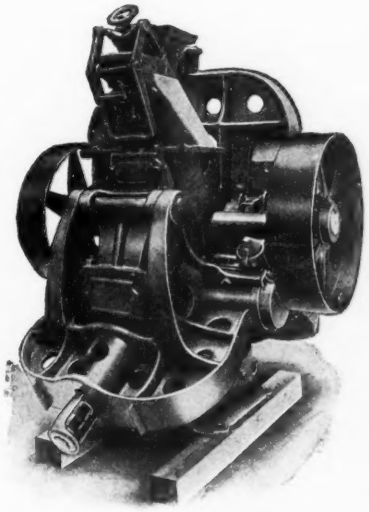
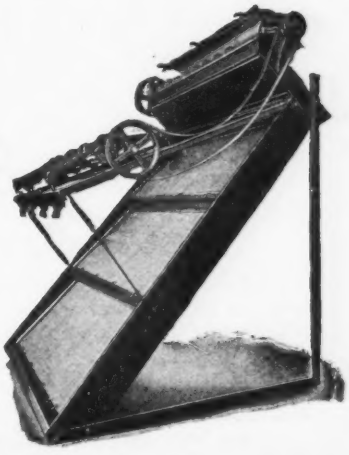
MAXECON MILL

Preliminary Grinder for Tube Mills



LIMESTONE ..... 20 to 40 Mesh
CEMENT CLINKER ..... 20 to 60 Mesh

MAXECON MILL
PERFECTION SEPARATOR



The UNIT that has LARGER OUTPUT with LESS POWER WEAR and ATTENTION than any other.

It will be to the interest of those who operate CEMENT PLANTS to know what the Maxecon Unit will do.

Drop us a line **We will be glad to tell you about it**

Kent Mill Company

10 Rapelyea Street **BROOKLYN, N. Y.**

SCHAFFER
Continuous Lime Hydrators

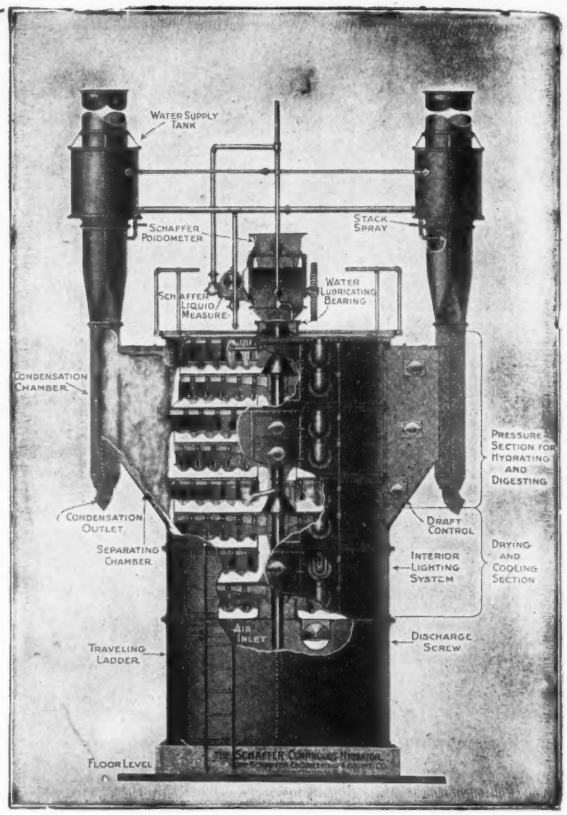
AUTOMATIC operation delivers lime by **weight,** not volume, to the Schaffer Hydrator. Automatically, water, too, is added in correct proportion—insuring a continuous flow of a superior product.

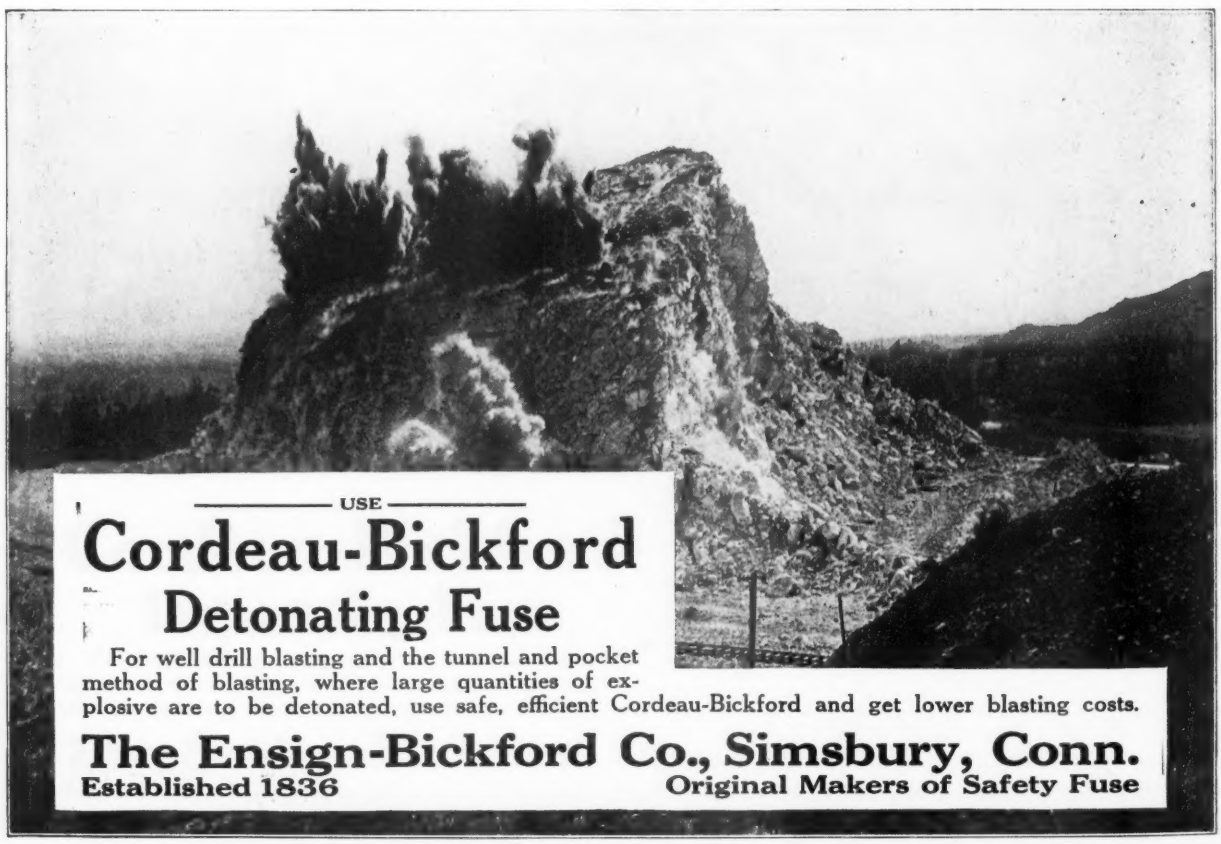
The flexibility of control enables the use of either high calcium or dolomite lime, while at the same time the automatic operation of Schaffer Hydrators solves the labor problem, as they require but little attention.

Our literature on the Schaffer Hydrator covers all the questions you now have in mind. Write for it at once!

Schaffer Engineering & Equipment Co.

Peoples Bank Bldg., PITTSBURGH, PA.





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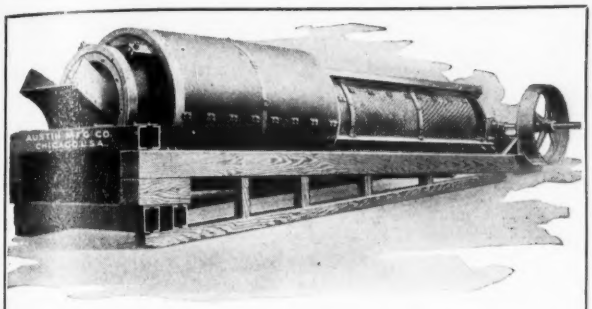
Cordeau-Bickford
Detonating Fuse

For well drill blasting and the tunnel and pocket method of blasting, where large quantities of explosive are to be detonated, use safe, efficient Cordeau-Bickford and get lower blasting costs.

The Ensign-Bickford Co., Simsbury, Conn.

Established 1836 **Original Makers of Safety Fuse**



Austin
Elevators—Screens—Crushers

THE Austin line is complete. Every step in the construction of a road has its specialized piece of Austin Equipment. Equipment that represents the highest type of engineering skill and the last ounce of boiled down experience.

Elevating Graders, Screens, and Crushers are three important members of the Austin line.

Quality of material, correctness of design and construction together with rapidity and economy of operation unquestionably stamp Austin Equipment as leaders in their field.

Austin Manufacturing Company

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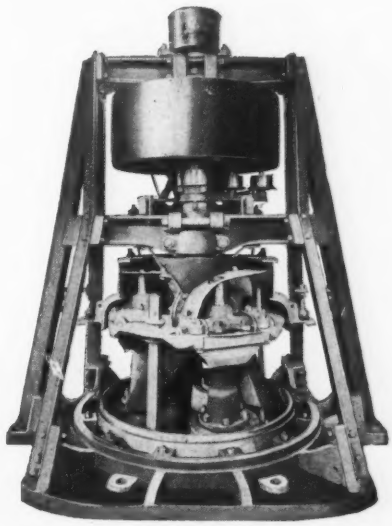
BRADLEY

3 Roll Mill

The ideal pulverizer for the agricultural limestone producer who desires a uniformly finely ground, finished product. Produces a fine material cheaper than other types of machines that grind coarser.



Why Not Use the Best?

The Bradley 3-Roll Pulverizer insures maximum output at minimum cost.

A self-contained mill pulverizing rock from 1 in. to 70% through 100 mesh or finer in single operation.

Simple to operate. Low maintenance cost.

A real mill for agricultural use.

Bradley Pulverizer Co.

Boston London Works, Allentown, Pa.

Manufacturers Giant Griffin and Bradley Hercules Mills

Increase Your Production

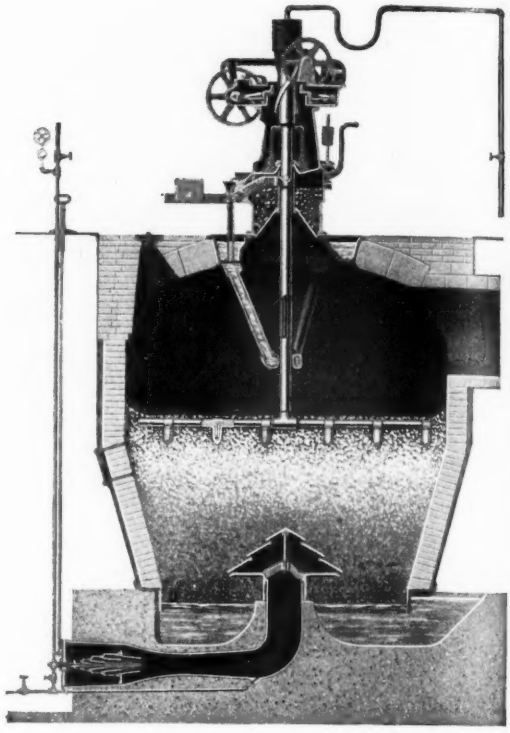
of high grade lime by heating your kilns with producer gas generated in

CHAPMAN Agitator Producers

They deliver a constant supply of high quality gas, thus insuring a uniform temperature in the kiln. This uniform supply of high quality gas burns with a long, clear flame which resembles the flame from a wood fire. The result is a greater production of first grade lime.

The Chapman Floating Agitator will increase the capacity and the efficiency of hand-poked producers already in operation.

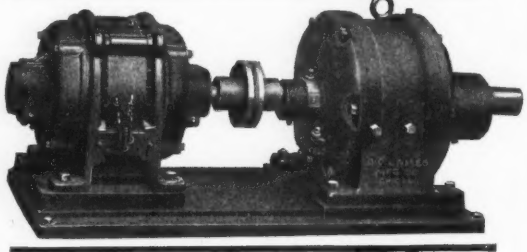
Write us for special information



The Chapman Engineering Company

Oliver Bldg. Pittsburgh — MT. VERNON, OHIO — 11 Broadway New York

James Speed-Reducing Transmissions



save space and save power. They are compact and easy to install. They are dust-proof and fool-proof. In cement, stone, and lime plants, where space is at a premium, and where dust conditions are unusually severe, James equipment for reducing motor speed appeals to the plant engineer. The power is delivered more economically and with less strain on the motor.

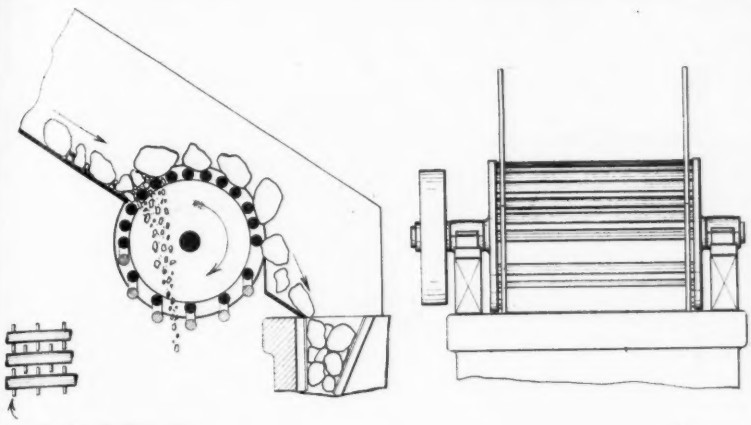
Any reduction of speed from the ratio of 4:1 to 1600:1 can be furnished.

Our engineering service is ready to assist you in definitely solving your problems connected with the economical delivery of power by direct connected motors.

Send for our latest bulletin, No. 7

D. O. James Mfg. Co.
1120 W. Monroe St., Chicago, Ill.

Provide Operating Economy



Equipped thus with steel fingers for SLABBY MATERIAL

ROSS

Automatic Drop-Bar

Grizzly Feeders and Screens

PATENTED

Rugged Foolproof
Simple Reliable

It Won't Block or Choke

The Ross Rotary Type Screen is specially adapted for heavy Grizzlying, Scalping, and Screening. It will handle the most abrasive materials with less wear than any other screen; requires fractional horsepower and no labor or attendance. In sizes from 1′ to 6′ diameter; any aperture from ½″ up.

Our Engineering Department will be glad to submit recommendations covering YOUR requirements

ROSS ENGINEERING COMPANY

37 West Van Buren Street, Chicago, Ill.

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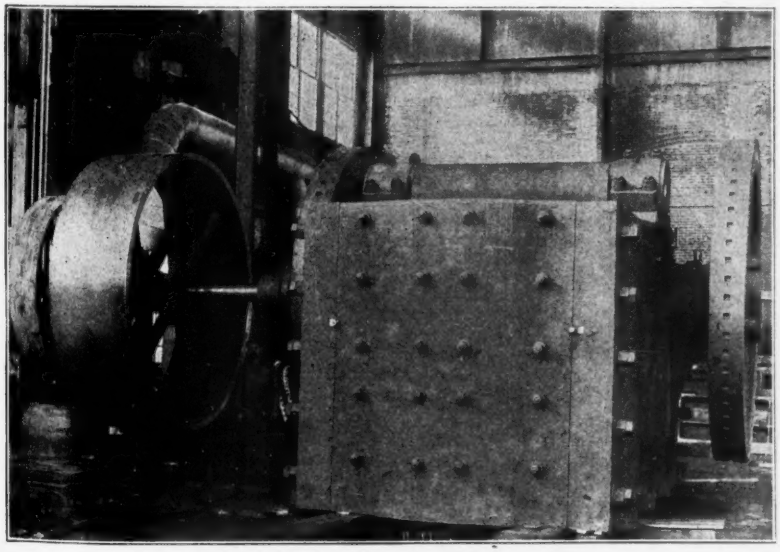
MASSIVE

IN PROPORTIONS
IN STRENGTH
IN DESIGN



A Wide Range of Sizes — All Designed for Continuous Duty

BUCHANAN

ALL STEEL

PATENTED

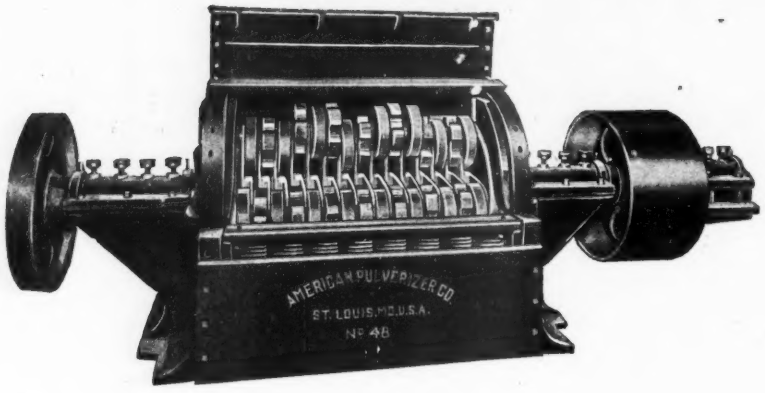
JAW CRUSHERS

Shall we send a copy of Bulletin No. 10?

C. G. Buchanan Co., Inc.

Manufacturers of crushing equipment and magnetic separators

90 West Street, New York



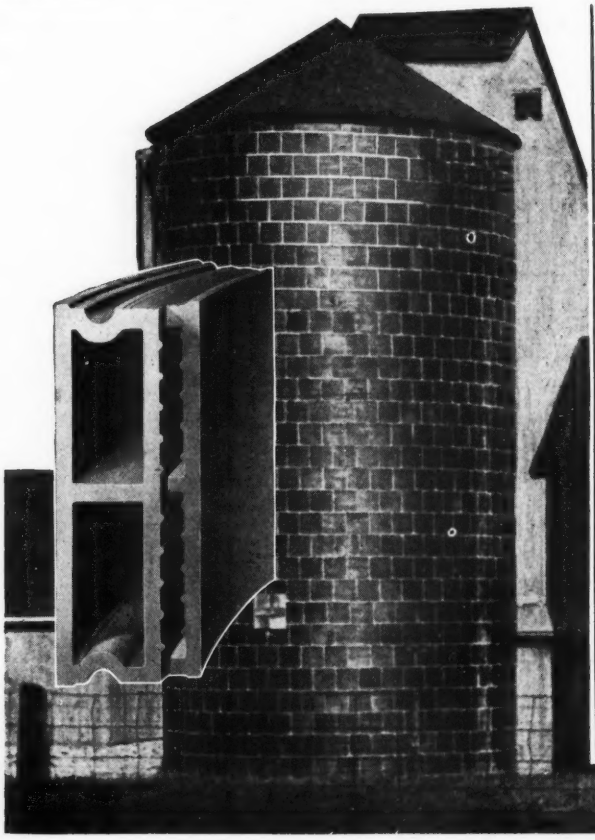
The Patented

AMERICAN RING PULVERIZER

has all the capacity, simplicity, reliability and economy to make it a high class, interest-paying investment.

The fact that it has met every demand—giving full and adequate service to users, is proven by the repeat business which is truly gratifying.

American Pulverizer Co. - St. Louis, Mo.



Preston Lansing Tile Storage Bins

Made of the ideal material for storing limestone, sand, making glass batch bins, etc.

Preston Lansing VITRIFIED TILE BINS

Moisture Proof—No Upkeep Expense

Special "ship-lap" joint construction with braces against each other; blocks with twisted steel reinforcing in an extra thick layer of concrete.

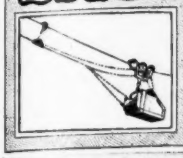
Write for catalog and prices

J. M. Preston Company
Dept. 413 Lansing, Mich.

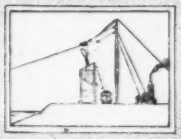
Factories at New Brighton, Pa., Uhrichsville, Ohio, Brazil, Ind., Ft. Dodge, Ia.

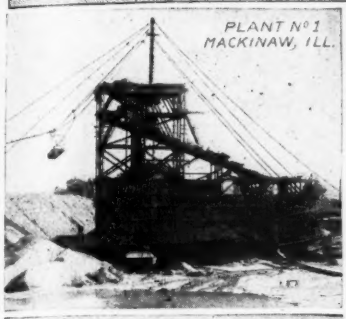
(Photo to left shows the Preston Lansing Storage Bin for the Becker Limestone Co., Lincoln Park, N. Y.)

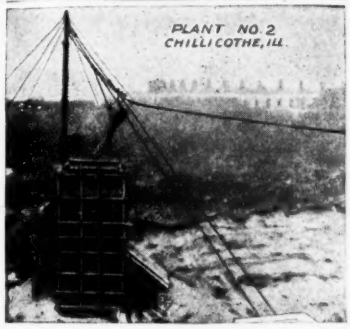
SAUERMAN DRAGLINE CABLEWAY EXCAVATORS



dig, convey, elevate and dump in one continuous movement, under entire control of one man.







The Four Plants of the McGrath Sand & Gravel Co. are all equipped with

SAUERMAN
Dragline Cableways

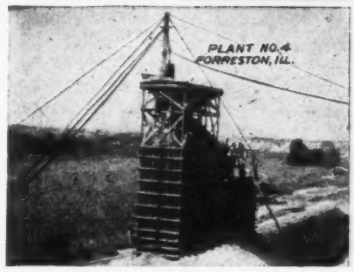
At Forreston, Ill., the McGrath Sand & Gravel Co. recently placed in operation their fourth sand and gravel plant.

This newest McGrath plant, like their three other plants at Mackinaw, Ill.; Chillicothe, Ill., and Pekin, Ill., is equipped with a Sauerman Dragline Cableway Excavator.

The case of the McGrath Sand & Gravel Co. and of many other sand and gravel producers from whom we have received repeat orders, is the best evidence as to the successful performance and reliability of Sauerman equipment.

We are at your service if you wish the suggestions of our engineers on the proper equipment for your particular conditions and requirements and you should by all means write for our No. 7 Catalog if you haven't a copy of this catalog in your files.

SAUERMAN BROS.
1140 Monadnock Bldg., Chicago



AMSCO
"THE TOUGHEST STEEL KNOWN"

Clark Reversible Dipper Tooth

(Patented)

A Heavy Duty Two-part Tooth

THE Clark reversible dipper tooth meets the most severe digging conditions, such as are encountered by the large revolving shovels in stripping the over-burden of coal, ore, etc. Likewise, it does excellent work in ordinary excavating.

The base or shank of the AMSCO Manganese Clark tooth for the large revolving stripping shovel is of the "I" beam construction, such as is shown above. This is particularly recommended for hard service, as it secures maximum strength with minimum weight.

When the Clark points, after long usage have worn to such an extent as to reduce efficiency, they can be reversed, thereby providing a new cutting edge. Only one bolt must be removed to reverse or renew the points. The bolt as you will note from the illustration is a wedge type bolt and is set parallel to the dipper lip. The nut is protected by bosses cast on the base to prevent it from shearing off.

Working under various conditions throughout the country, the AMSCO Manganese Clark reversible tooth has been considered an eminently satisfactory and economical design. It is made entirely of AMSCO Manganese Steel—consequently long life is assured.

Write for information regarding attractive free exchange proposition.

American Manganese Steel Company

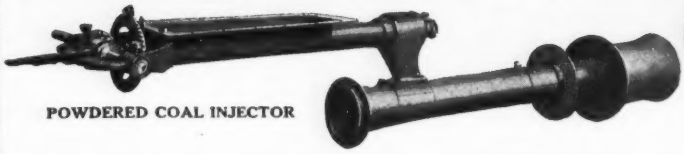
General Sales Offices: Chicago Heights, Ill.

District Sales Offices:

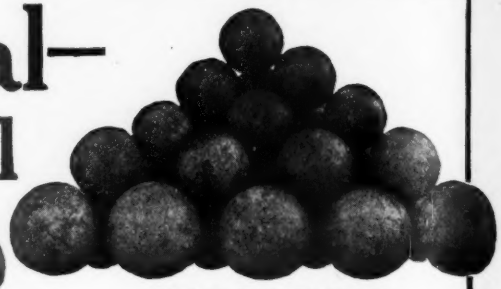
New York Chicago Pittsburgh Minneapolis Salt Lake City San Francisco
Denver Los Angeles Seattle Portland, Ore. New Castle, Dela.

WORKS: Chicago Heights, Ill. New Castle, Dela. Oakland, Calif.

Powdered Coal—the Economical Fuel



POWDERED COAL INJECTOR



FORGED STEEL BALLS FOR PRELIMINARY GRINDING

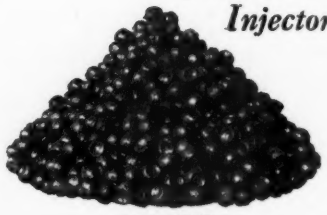
WITH properly designed combustion chambers it is possible to burn 98% of the cumbustible matter of powdered lignites, low grade bituminous coals, mine waste and secure high combustion efficiency. As little as ten to fifteen per cent excess air is consumed with practically no smoke or carbon monoxide in flue gases.

We Manufacture a Complete Line of Powdered Coal Equipment.

Bulletin No. 1455-Q will interest you.

Grinders
Dryers
Pulverizers
Conveyors
Feeders
Injectors

ALLIS-CHALMERS
Manufacturing Company
Milwaukee, Wis., U. S. A.
District Offices in All Leading Cities.



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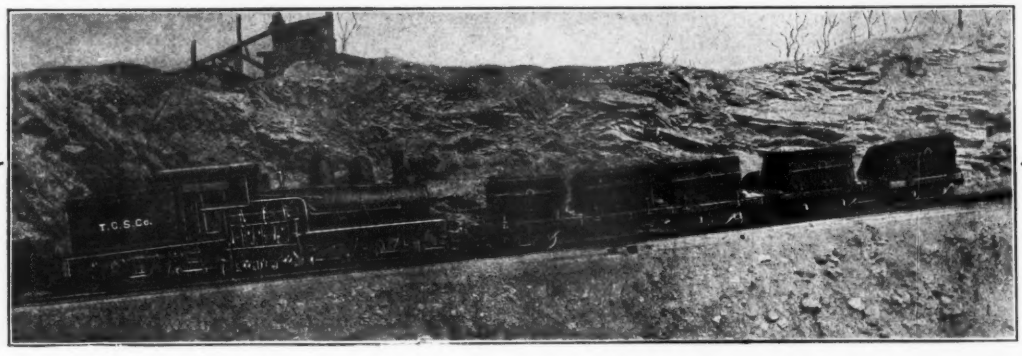

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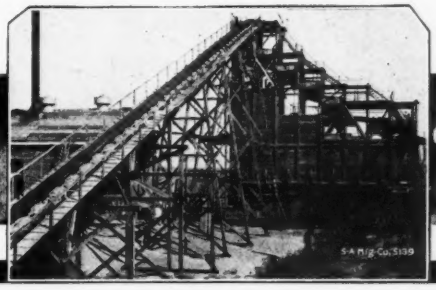

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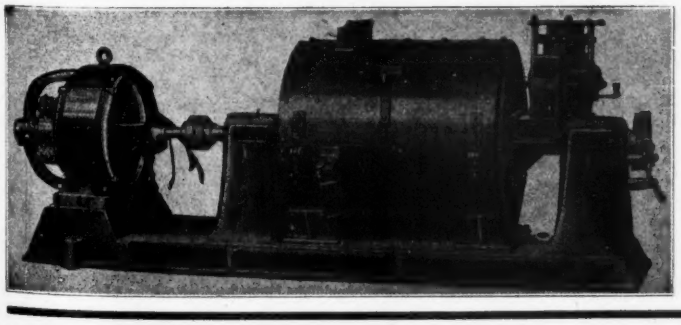

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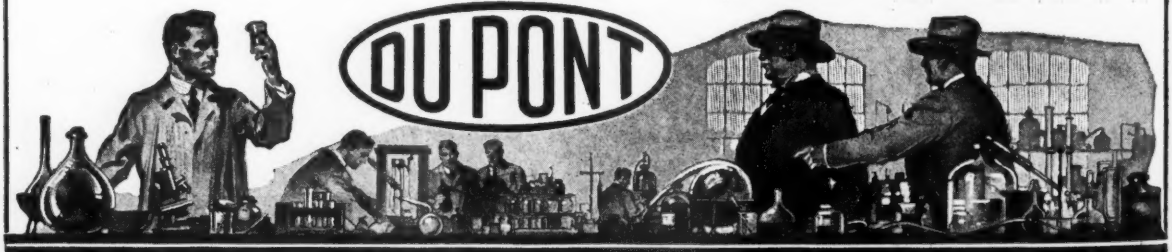

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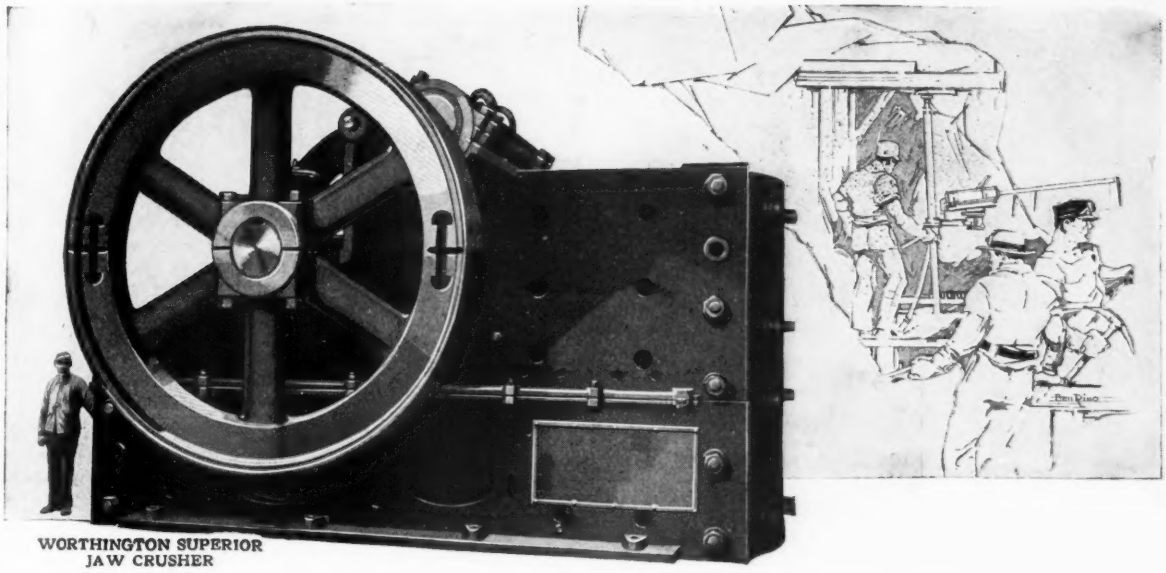

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